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SPECIAL ANNOUNCEMENT

The report series USSR Scientific Abstracts and East European Scientific Abstracts, published by the Joint Publications Research Service, have been expanded to include abstracts formerly published by Office of Technical Services under the title Current Review of the Soviet Technical Press, which has been discontinued with the 9 October 1964 issue.

Published under nine subseries -- Bio-Medical Sciences, Chemistry, Cybernetics, Computers and Automation Technology, Earth Sciences (East Europe only), Electronics and Electrical Engineering, Engineering and Equipment, Metals and Metallurgy, and Physics and Mathematics -- the enlarged Scientific Abstracts reports will provide a finer breakdown of information in specific fields of interest for users. Any or all of the subseries in either the USSR or East European areas can be ordered. In addition, one report series entitled Communist Chinese Scientific Abstracts, is also offered, containing translations of selected abstracts of Chinese works published in the Soviet Referativnyy Zhurnal (Abstracts Journal) series.

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U.S. DEPARTMENT OF COMMERCE
Luther H. Hodges, *Secretary*

OFFICE OF TECHNICAL SERVICES
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Use of funds for printing this publication approved by the Director of the Bureau of the Budget, June 30, 1961.

U.S. Government Research Reports

This publication is issued twice a month to announce new reports of research and development released by the Department of Defense and certain other agencies of the Federal Government sponsoring research and development programs. Unless otherwise indicated, reports listed are available from the Office of Technical Services. The documents are available in original, reproduced, or microfiche copy only.

The first section of U. S. Government Research Reports (USGRR) is prepared for the Defense Documentation Center and is called "Technical Abstract Bulletin" (TAB). (DDC is a Department of Defense agency which services DOD agencies and their contractors with military research information.) The next section is called "Non-Military and Older Military Research Reports." Here are listed new reports of civilian agencies of the Government and military research reports not to be found in the "TAB." Most of these older military reports have been acquired by OTS in response to specific industry requests.

Atomic Energy Commission reports available from OTS are listed in Nuclear Science Abstracts. NSA is available to the general public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C., at $30 a year (domestic), $37 a year (foreign). Single copy cost, $1.75 (plus 25 percent for foreign mailing).

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SPECIAL LITERATURE SEARCHING FEE INCREASED

Effective October 1, 1964, the fee for Special Literature Searches by the Office of Technical Services and the Science and Technology Division, Library of Congress, is increased from $8 per hour to $11 per hour of searching time. The increase is necessary to permit the agencies to recover the actual costs of these searches.

The Special Literature Searching Service is a subscription-type service to provide subscribers with bibliographic information tailored to their specifications. For information on this service, write to OTS, U. S. Department of Commerce, Washington, D. C. 20230.

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In connection with the above developments, OTS is consolidating all its documentation operations, including printing and document storage and dissemination, in one building. All services to the customer should be greatly improved, including more prompt servicing of orders for documents.

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An interagency agreement, announced by the White House on February 28, called upon the Department of Commerce to strengthen and broaden the functions of OTS under Public Law 776 to make the agency more effectively a "Clearinghouse for Federal Scientific and Technical Information."

Steps to develop such a Clearinghouse are being taken as rapidly as possible, and the Office of Technical Services has been extensively reorganized to effectively carry out the expanded functions.

The Clearinghouse provides a single point of contact through which current research efforts and the results of Government-sponsored research in science and technology can be made available to industry, commerce, and the general public. The Clearinghouse collects, organizes, publicizes, and provides reference, referral, and sales services for technical reports and translations received from domestic and foreign sources. The primary aim of the Clearinghouse is to achieve through interagency agreement and cooperation a unified documentation and distribution system for Government-generated technical reports and information on research in progress.

Another significant development, in line with the interagency agreement, was the signing on March 9 of an agreement between the Department of Commerce and the Department of Defense providing for OTS to handle all processing and distribution of unclassified/unlimited DOD reports, a function formerly performed largely by the Defense Documentation Center, except that OTS was responsible for announcement, reproduction, and sale of these documents to the public.

Prices

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TECHNICAL ABSTRACT BULLETIN

1. Aircraft and Flight Equipment

AD-604 420 Div. 1, 12
OTS Prices: HC $4.00/MF $0.75

Sperry Phoenix Co., Ariz.
DIGITAL ADAPTIVE FLIGHT CONTROL SYSTEM, PHASE II.
Final rept. for May 62-Sep 63,
by R. E. Andeen and P. P. Shipley. May 64, 109p
Contract AF33 657 8658, Proj. 8225, Task 82181
ASD TDR63 854

Unclassified report

Descriptors: (*Flight control systems, Digital systems), (*Adaptive control systems, Synthesis), Aerospace craft, Dynamics, Simulation, Mathematical analysis, Band-pass filters, Noise, Optimization, Functions.

An investigation was made to determine if the dynamics of an aerospace vehicle might be identified more readily if represented in some other form than a z-transform. An analysis and simulation performed indicate that a representation in terms of linear band-pass filters is preferable. An investigation was made of an implicit response matching technique applicable to both identification and synthesis, which form the bases for self-adaptive control. In a digital simulation the implicit technique was able to simultaneously identify five parameters of a typical aerospace vehicle within 2 seconds without noise, and within 5 seconds with 30 percent noise. An investigation and digital simulation was made of a hybrid digital adaptive flight control system which uses the implicit technique. The system identified 4 parameters of a typical vehicle, and adjusted 2 parameters of the flight control system to provide optimum response. (Author)

AD-604 442 Div. 1, 16
OTS Prices: HC $4.00/MF $0.75

Bureau of Sport Fisheries and Wildlife, Washington, D. C.
BIOLOGICAL STUDIES OF THE PROBLEM OF BIRD HAZARD TO AIRCRAFT.
Progress rept. for 1 Apr 62-30 Jun 63,
by John L. Seubert. 30 Jun 63, 123p
Contract FAA/BRD A90

Unclassified report

Descriptors: (*Aviation accidents, Birds), (*Birds, Aviation accidents), Aviation safety, Aircraft, Airports, Hazards, Commercial planes, Damage, Biology, Physiology, Flight.

The objective of this research was to develop methods of minimizing or alleviating bird hazards to aircraft operation at or near airports. The research program included the following investigations: problem analysis; population studies of problem species; the responses of birds to various stimuli; and the development and evaluation of bird population reduction methods. Other program activities included liaison with foreign research workers and technical assistance to Federal agencies and airport managements seeking advice on bird hazard problems.

AD-604 498 Div. 1
OTS Prices: HC $4.00/MF $0.75

Institute of Tech., Univ. of Minnesota, Minneapolis.
THEORETICAL PARACHUTE INVESTIGATIONS.
Progress rept. no. 20, 1 Dec 61-28 Feb 62,
by H. G. Heinrich, T. Riabokin, S. K. Ibrahim, E. L. Haak, and R. J. Niccum. 28 Feb 62, 101p
Contract AF33 616 8310, Proj. 6065, Task 60252

Unclassified report

Descriptors: (*Parachutes, Aerodynamic characteristics), Wake, Subsonic flow, Supersonic flow, Pressure, Drag, Turbulence, Wind tunnels, Deceleration, Experimental data. Stability, Stresses, Porosity.

Contents: investigation of wake effects on the behavior of parachutes and other retardation devices behind large bodies of subsonic and supersonic speeds, investigation of basic stability parameters of conventional parachutes, theoretical study of supersonic parachute phenomena, theoretical analysis of the dynamics of the opening parachute, statistical analysis of extraction time, deployment time, opening time, and drag coefficient for aerial delivery parachutes and systems, study of basic principles of new parachutes and retardation devices, gliding aerodynamic decelerator, effective porosity studies, study of flow patterns of aerodynamic decelerators by means of the surface wave analogy, stress analysis of the T-10 troop parachute.

AD-604 630 Div. 1, 9
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A SIMPLIFIED EXPRESSION FOR THE DIHEDRAL EFFECT OF A FLEXIBLE WING,
by W. P. Rodden. 18 Jan 55, 4p P-625

Unclassified report

Descriptors: (*Wings, Flexible structures), (*Roll, Numerical analysis), Aerodynamic loading, Dihedral angle, Angle of attack, Moments, Wind tunnels, Model tests.

By making two reasonable approximations a variation of sideslip rolling moment coefficient with load factor was obtained for an airplane. The first approximation is to replace the wing normal load factor by the airplane normal load factor; the second is to assume the wing deflection mode to be parabolic.

AD-604 684 Div. 1, 18, 19, 30
OTS Prices: HC $2.00/MF $0.50

General Electric Co., Johnson City, N. Y.
ANALYTICAL INVESTIGATION OF CONTROL REQUIREMENTS FOR HIGH SPEED LOW ALTITUDE PENETRATION.
Final rept. (Brief), 1 Jul 63-10 May 64,
by R. P. Quinlivan, G. Tye, and H. H. Westerholt.
Jun 64, 30p
Contract AF33 657 11318, Proj. 8226, Task 822601
FDL TDR64 104

Unclassified report

Descriptors: (*Terrain avoidance, Automatic navigators), (*Flight control systems, Automatic), (*Adaptive control systems, Supersonic planes), Flight paths, Flight simu-

FEDERAL REGIONAL TECHNICAL REPORT CENTERS

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Volume 32	July - December 1959	$1.00

For information regarding the availability of earlier indexes write to Office of Technical Services, U. S. Department of Commerce, Washington, D. C. 20230.

CLIMATIC STUDIES FOR PROPOSED LANDING SYSTEM FOR WILLIAMSON-JOHNSON INTERNATIONAL AIRPORT, DULUTH, MINNESOTA.
Final rept.
Jun 64, 88p
Proj. 114-20R
FAA RD64 54 V1

Unclassified report

Descriptors: (*Climatology, All-weather aviation), (*All-weather aviation, Landing aids), (*Landing aids, All-weather aviation), Landing fields, Minnesota.

This report consists of 32 volumes of climatological data for 32 different major airports. Ceiling, visibility, wind and weather information is grouped seasonally and by various periods of the day. Various weather categories are tabulated, in most cases from 10 years of data, to act as an aid in making decisions affecting the landing systems at these 32 air terminals. (Author)

AD-604 836 Div. 1, 2
OTS Prices: HC $3.00/MF $0.75

National Weather Records Center, Asheville, N. C.
CLIMATIC STUDIES FOR PROPOSED LANDING SYSTEM FOR INTERNATIONAL AIRPORT, LOS ANGELES, CALIFORNIA.
Final rept.
Jun 64, 84p
Proj. 114 20R
FAA RD64 54 V2

Unclassified report

Descriptors: (*Climatology, All-weather aviation), (*All-weather aviation, Landing aids), (*Landing aids, All-weather aviation), Landing fields, California.

This report consists of 32 volumes of climatological data for 32 different major airports. Ceiling, visibility, wind and weather information is grouped seasonally and by various periods of the day. Various weather categories are tabulated, in most cases from 10 years of data, to act as an aid in making decisions affecting the landing systems at these 32 air terminals. (Author)

AD-604 837 Div. 1, 2
OTS Prices: HC $3.00/MF $0.75

National Weather Records Center, Asheville, N. C.
CLIMATIC STUDIES FOR PROPOSED LANDING SYSTEM FOR O'HARE INTERNATIONAL AIRPORT, CHICAGO, ILLINOIS.
Final rept.
Jun 64, 86p
Proj. 114 20R
FAA RD64 54 V3

Unclassified report

Descriptors: (*Climatology, All-weather aviation), (*All-weather aviation, Landing aids), (*Landing aids, All-weather aviation), Landing fields, Illinois.

This report consists of 32 volumes of climatological data for 32 different major airports. Ceiling, visibility, wind and weather information is grouped seasonally and by various periods of the day. Various weather categories are tabulated, in most cases from 10 years of data, to act as an aid in making decisions affecting the landing systems at these 32 air terminals. (Author)

AD-604 838 Div. 1, 2
OTS Prices: HC $3.00/MF $0.75

National Weather Records Center, Asheville, N. C.
CLIMATIC STUDIES FOR PROPOSED LANDING SYSTEM FOR LOGAN INTERNATIONAL AIRPORT, BOSTON, MASSACHUSETTS.
Final rept.
Jun 64, 86p
Proj. 114 20R
FAA RD64 54 V4

Unclassified report

Descriptors: (*Climatology, All-weather aviation), (*All-weather aviation, Landing aids), (*Landing aids, All-weather aviation), Landing fields, Massachusetts.

This report consists of 32 volumes of climatological data for 32 different major airports. Ceiling, visibility, wind and weather information is grouped seasonally and by various periods of the day. Various weather categories are tabulated, in most cases from 10 years of data, to act as an aid in making decisions affecting the landing systems at these 32 air terminals. (Author)

AD-604 839 Div. 1, 2
OTS Prices: HC $3.00/MF $0.75

National Weather Records Center, Asheville, N. C.
CLIMATIC STUDIES FOR PROPOSED LANDING SYSTEM FOR MUNICIPAL AIRPORT, KANSAS CITY, MISSOURI.
Final rept.
Jun 64, 84p
Proj. 114 20R
FAA RD64 54 V6

Unclassified report

Descriptors: (*Climatology, All-weather aviation), (*All-weather aviation, Landing aids), (*Landing aids, All-weather aviation), Landing fields, Missouri.

This report consists of 32 volumes of climatological data for 32 different major airports. Ceiling, visibility, wind and weather information is grouped seasonally and by various periods of the day. Various weather categories are tabulated, in most cases from 10 years of data, to act as an aid in making decisions affecting the landing systems at these 32 air terminals. (Author)

AD-604 840 Div. 1, 2
OTS Prices: HC $3.00/MF $0.75

National Weather Records Center, Asheville, N. C.
CLIMATIC STUDIES FOR PROPOSED LANDING SYSTEM FOR LAMBERT FIELD, SAINT LOUIS, MISSOURI.
Final rept.
Jun 64, 84p
Proj. 114 20R
FAA RD64 54 V7

Unclassified report

Descriptors: (*Climatology, All-weather aviation), (*All-weather aviation, Landing aids), (*Landing aids, All-weather aviation), Landing fields, Missouri.

This report consists of 32 volumes of climatological data for 32 different major airports. Ceiling, visibility, wind and weather information is grouped seasonally and by various periods of the day. Various weather categories are tabulated, in most cases from 10 years of data, to act as an aid in making decisions affecting the landing systems at these 32 air terminals. (Author)

lators, Terrain models, Military tactics, Penetration, Effectiveness, Tests.

The purpose of this work was investigation of control requirements for high speed, low altitude penetration. The course of action taken made use of a moderately sophisticated simulation of all elements of the automatic control of an aircraft in pitch. The control techniques which were used are a departure in concept from those popularly used to date. Evaluation of the simulated system performance was the chief means of system analysis. The evaluations were made using four terrain samples, and included seventeen combinations of aircraft configuration and flight conditions, gust disturbances, and radar errors. A limited evaluation of manual control was made. In the interests of brevity and the desire to keep this 'Report Brief' unclassified, specific results have not been included. It is concluded that the conceptual approach and techniques studied promise to give advanced automatic terrain following systems with superior performance in real environments without adjustment for changes in flight dynamics or terrain characteristics. (Author)

AD-604 731 Div. 1, 9
OTS Prices: HC $2.00/MF $0.50

David Taylor Model Basin, Washington, D. C.
WIND-TUNNEL INVESTIGATION OF FAVORABLE INTERFERENCE TO INCREASE LIFT-DRAG RATIOS OF SUPERSONIC AIRCRAFT: PART II: AN OPTIMIZED WING-BODY-INLET CONFIGURATION,
by Richard M. Hartley, Norman G. Ziegler, and David W. Moxley, Jr. Jun 64, 46p
DTMB Aero 1063
Unclassified report

See also AD-601 232

Descriptors: (*Wing-body configurations, Optimization), (*Wing inlets, Supersonic planes), Jet engine inlets, Interference, Lift, Drag, Shock waves, Airplane models, Wind tunnels, Wings.

The results of wind-tunnel tests conducted at a Mach number of 2.87 to investigate favorable interference effects on wing-body-inlet configurations are presented. The engine air inlet location and the body indentation angle for maximum lift increments were determined. These favorable lift increments correspond to about 20 percent of the cruise lift required for an attack aircraft. A fence, attached to the wing to reflect the shock wave emanating from the engine air inlet and to intensify the pressure field, increased the inboard lift but not sufficiently to overcome the resulting loss in lift from the outboard section of the wing. (Author)

AD-604 757 Div. 1
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
RED STAR ON REFUELING AIRCRAFT IN THE AIR,
by Yu. Rusyantsev. 5 Jul 55, 8p T-46
TT 64 71251
Unclassified report

Trans. from Krasnaya Zvezda (USSR) 1955, 31 May, p. 3.

Descriptors: (*Refueling in flight, Bombers), Cables (Mechanical), Hoses, Pipes, USSR.

The first part of the article discusses the advantages -- increased flight range and maneuverability -- to be gained by single and multiple inflight refueling of high speed bombers and fighters. The second part of the article describes the two principal existing methods of aerial refueling -- the flying boom and the probe-and-drogue systems -- and discusses their relative advantages and disadvantages and the problems generally associated with aerial refueling.

AD-604 788 Div. 1
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
COLLECTION OF SOME GERMAN DATA ON SPECIAL TYPE LANDING GEARS: SEVEN PAPERS,
by Woyczechowski, Feldinger, and Kalinowski.
1 Aug 47, 32p T-2
TT 64 71282
Unclassified report

Trans. of abstracts from unidentified German sources, n.p., n.d.

Descriptors: (*Landing gear, Take-off), Jettisonable equipment, Parachutes, Tests, Friction, Design, Abstracting.

Discussion is presented of the means with the aid of which overloaded airplanes may take off. Consideration is given to the problems of auxiliary rolling and jettisonable gears, as well as a brief analysis of the problems in launching large size, overloaded airplanes with the aid of a catapult or other means, such as an electrically driven take-off cart. (Author)

AD-604 798 Div. 1, 26
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
AN AIRFRAME PRODUCTION FUNCTION,
by Armen Alchian. 20 Oct 49, 18p P-108
Unclassified report

Descriptors: (*Airframes, Production), (*Labor, Costs), Aircraft industry, Economics, Mathematical analysis, Functional analysis.

AD-604 813 Div. 1, 12
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
SATELLITE WEATHER RECONNAISSANCE,
by S. M. Greenfield and W. W. Kellogg. 12 Jun 58, 22p P-1402
Unclassified report

Prepared for pub. in Astronautics.

Descriptors: (*Meteorological satellites, Weather forecasting), (*Weather forecasting, Meteorological satellites), Meteorology, Reconnaissance satellites, Cloud cover, Photography, Mathematics, Measurement, Moisture, Temperature, Ozone, Solar radiation, Feasibility studies.

Various aspects of weather reconnaissance by satellites including limitations, capabilities relative to present methods, and growth potential are discussed. (Author)

AD-604 835 Div. 1, 2
OTS Prices: HC $3.00/MF $0.75

National Weather Records Center, Asheville, N. C.

2. Astronomy, Geophysics and Geography

AD-604 328 Div. 2, 5, 12
OTS Prices: HC $1.00/MF $0.50

Redstone Scientific Information Center, Redstone Arsenal, Ala.
COLLISIONS OF THE WEST FORD NEEDLES WITH MICROMETEORITES,
by A. Sauval. 28 Jul 64, 14p
RSIC 235; TT 64 71231

Unclassified report

Trans. of Société Royale des Sciences [de] Liége. Bulletin (Belgium) 1963, v. 32, no. 1/2, p. 54-61.

Descriptors: (*Meteorites, Satellites(Artificial)), (*Satellites (Artificial), Meteorites), Terminal ballistics, Targets, Vaporization, Orbital trajectories, Communication satellites (Passive), Space environmental conditions.

It is shown that collisions of micrometeorites with West Ford Project needles are sufficiently numerous to break the needles in several years. These collisions may affect the lifetime of the orbit (predicted period of eight years) and of the experiment. (Author)

AD-604 339 Div. 2
OTS Prices: HC $1.00/MF $0.50

Massachusetts Inst. of Tech., Cambridge.
MEASUREMENT OF DROP SIZE DISTRIBUTION AND LIQUID WATER CONTENT IN NATURAL CLOUDS.
Final rept.,
by D. P. Keily. 15 Feb 64, 23p
Contract AF19 628 259, Proj. 8620, Task 862005
AFCRL 64 621

Unclassified report

Descriptors: (*Clouds, Moisture), Fog, Water vapor, Particle size, Surface area, Distribution, Measurement, Static electricity, Probes (Electromagnetic), Recording systems, Airborne, Electrical corona, Electric arcs, Electrical conductance, Measuring devices (Electrical and Electronic), Signal-to-noise ratio, Radiofrequency interference, Oscilloscopes, Electromagnetic pulses, Photographic analysis, Drops.

Clouds drops striking a charged metal target are shown to produce an electric pulse whose shape indicates that the electrical contact process is a succession of events probably but not certainly including corona, arcing, and conduction. Nevertheless, the pulse amplitude is closely proportional to the droplet surface area. (Author)

AD-604 340 Div. 2
OTS Prices: HC $4.00/MF $0.75

Washington Univ., Seattle.
LIQUID FILM HYGROMETRY.
Scientific rept. no. 2,
by Robert J. Charlson and K. J. K. Buettner.
May 64, 118p
Contract AF19 628 303, Proj. 6020, Task 602002
AFCRL 64 493

Unclassified report

Descriptors: (*Meterological instruments, Hygrometers), (*Hygrometers, Design), (*Humidity, Measurement), Films, Liquids, Absorption, Gas flow, Water vapor, Vapor pressure, Capacitors, Probes (Electromagnetic), Calibration.

Based on a need for a hysteresis-free and theoretically predictable hygrometer, the studies were concerned with the development of a liquid phase absorption hygrometer. This instrument, which senses the partial pressure of water vapor of a sample gas flow, utilizes a heterogeneous mixture of a hygroscopic liquid coated on the surface of an inert granular solid as the dielectric of a capacitor. A theoretical analysis of the response of this instrument based on Raoult's law and the Clausius-Mosotti equation is made and an experimental demonstration of the applicability of this theory is presented. Other parts of the theoretical treatment include an analysis of the time response, the temperature dependence and the effects of changes in dielectric composition. Essential agreement with the theory was found in all the experimental work. Technical details used in fabricating three prototype and two field portable instruments are given. The results of one field experiment are given to demonstrate the utility of the liquid film hygrometer. (Author)

AD-604 356 Div. 2
OTS Prices: HC $1.00/MF $0.50

New Mexico State Univ., University Park.
PLANETARY AND LUNAR RESEARCH IN THE PHOTOGRAPHIC INFRARED, VISIBLE AND ULTRAVIOLET.
Semi-annual rept. no. 6, 1 Oct 63-31 Mar 64,
by Clyde W. Tombaugh. May 64, 7p
Grant DA ARO D31 124G41

Unclassified report

Descriptors: (*Moon, Photography), (*Planets, Photography), (*Photographic equipment, Astrophysics), Infrared photography, Photographic techniques, Infrared spectroscopy, Ultraviolet spectroscopy, Photographic equipment.

A summary of photographic and spectroscopic observations is given for the period covered.

AD-604 362 Div. 2
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE MESOSPHERE,
by E. S. Batten. Oct 61, 10p P-2477

Unclassified report

Paper prepared for publication in the 1962 Yearbook of the McGraw-Hill Encyclopedia of Science and Technology.

Descriptors: (*Atmospheric sounding, Upper atmosphere), (*Upper atmosphere, Meteorological parameters), Atmospheric temperature, Wind, Sounding rockets.

During the 1960--61 period, scientific activity increased in the mesosphere prompted by an accelerated rocket program. Small meteorological rockets were developed and used more or less synoptically to probe the atmosphere to heights of 70 km. The data collected from these rockets at locations in the United States, Canada, and the Pacific Ocean, combined with data collected during the IGY, have confirmed old concepts of the circulation and temperature structure of the mesosphere and provided the investigators with new puzzles to be solved. (Author)

AD-604 841 Div. 1, 2
OTS Prices: HC $3.00/MF $0.75

National Weather Records Center, Asheville, N. C.
CLIMATIC STUDIES FOR PROPOSED LANDING SYSTEM FOR INTERNATIONAL AIRPORT, PHILADELPHIA, PENNSYLVANIA.
Final rept.
Jun 64, 86p
Proj. 114 2OR
FAA RD64 54 V8

Unclassified report

Descriptors: (*Climatology, All-weather aviation), (*All-weather aviation, Landing aids), (*Landing aids, All-weather aviation), Landing fields, Pennsylvania.

This report consists of 32 volumes of climatological data for 32 different major airports. Ceiling, visibility, wind and weather information is grouped seasonally and by various periods of the day. Various weather categories are tabulated, in most cases from 10 years of data, to act as an aid in making decisions affecting the landing systems at these 32 air terminals. (Author)

AD-604 842 Div. 1, 2
OTS Prices: HC $3.00/MF $0.75

National Weather Records Center, Asheville, N. C.
CLIMATIC STUDIES FOR PROPOSED LANDING SYSTEM FOR LOVE FIELD, DALLAS, TEXAS.
Final rept.
Jun 64, 84p
Proj. 114 2OR
FAA RD64 54 V9

Unclassified report

Descriptors: (*Climatology, All-weather aviation), (*All-weather aviation, Landing aids), (*Landing aids, All-weather aviation), Landing fields, Texas.

This report consists of 32 volumes of climatological data for 32 different major airports. Ceiling, visibility, wind and weather information is grouped seasonally and by various periods of the day. Various weather categories are tabulated, in most cases from 10 years of data, to act as an aid in making decisions affecting the landing systems at these 32 air terminals. (Author)

AD-604 843 Div. 1, 2
OTS Prices: HC $3.00/MF $0.75

National Weather Records Center, Asheville, N. C.
CLIMATIC STUDIES FOR PROPOSED LANDING SYSTEM FOR MUNICIPAL AIRPORT, BIRMINGHAM, ALABAMA.
Final rept.
Jun 64, 86p
Proj. 114 20R
FAA RD64 54 V19

Unclassified report

Descriptors: (*Climatology, All-weather aviation), (*All-weather aviation, Landing aids), (*Landing aids, All-weather aviation), Landing fields, Alabama.

This report consists of 32 volumes of climatological data for 32 different major airports. Ceiling, visibility, wind and weather information is grouped seasonally and by various periods of the day. Various weather categories are tabulated, in most cases from 10 years of data, to act as an aid in making decisions affecting the landing systems at these 32 air terminals. (Author)

AD-604 894 Div. 1, 9, 30
OTS Prices: HC $4.00/MF $1.00

Airesearch Mfg. Co., Phoenix, Ariz.
GEM CONTROL SYSTEM STUDY.
Progress rept. for Nov. 62-Feb 64,
by D. E. Litherland. 1 May 64, 141p AP-5073-R
Contract Nonr3173 00

Unclassified report

See also AD-296 225

Descriptors: (*Ground effect machines, Simulators), (*Analog computers, Flight simulators), Flight control systems, Aerodynamic characteristics, Display systems, Electronic equipment, Design.

An analog computer dynamic simulation of ground effect machines (GEM'S) is discussed. The primary objective of this work has been to develop, design, and test a completely universal GEM simulation system. During 1962, the initial computer program's usefulness was found to be limited by the operator's control system and the poor operator data presentation system. Efforts were expended to eliminate these deficiencies by accomplishment of the following tasks: (a) Evaluation of the basic simulator system to establish design criteria; (b) the design and fabrication of a prototype operator's control station; (c) the development, design, and fabrication of a visual presentation system; (d) integration of the operator's control station and visual generator system into the analog computer program; and (e) development of an ocean wave generating system. (Author)

AD-605 046 Div. 1, 17
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
BERYLLIUM AS AN AIRCRAFT STRUCTURAL MATERIAL,
by George A. Hoffman. 28 May 56, 36p P-871

Unclassified report

Descriptors: (*Beryllium, Airframes), (*Airframes, Beryllium), (*Structural parts, Beryllium), Mechanical properties, Costs, Toxicity, Brittleness, Loading (Mechanics), Structures, Mathematical analysis, Weight, Economics, Transport planes, Design.

Aircraft structures made of various metallic elements are compared according to relative weight, and the lightest structure is shown to be made of beryllium. The properties of beryllium are used to evaluate its efficiency in structural components, and beryllium structures are shown to weigh about half as much as conventional structures. An example is given of the advantages that may be obtained by using beryllium in transport airplanes. The deterrents to the use of beryllium are listed and the problem of brittleness is discussed. The paper concludes with suggestions for research. (Author)

Contract AF19 628 4014, Grant NSF GP846
Proj. 8605, Task 860502
AFCRL 64 451

Unclassified report

Descriptors: (*Ionosphere, Luxemberg effect), (*Luxemberg effect, Ionosphere), Radio waves, Radio transmitters, Attenuation, Ionospheric propagation, Electrons, Density, Phase measurement, Measurement, Data.

This report describes the results of the measurement of phase and amplitude radio wave interaction made during the period of January 1, 1964, through March 31, 1964 at N. Lat. 40 deg 47 min, W. Long. 77 deg 57 min. The objective is to study the properties of ionospheric D-region using radio wave interaction effect.

AD-604 436 Div. 2, 30
OTS Prices: HC $5.00/MF $1.00

Colorado State Univ., Fort Collins.
EXPERIMENTS IN OBJECTIVE UPPER-WIND ANALYSIS AND FORECASTING.
Final rept. for 1 Aug 62-22 Nov 63,
by Elmar R. Reiter and Patricia E. White. Jul 64, 176p
CSU-ASTP-50,
Contract ARDS450, Proj. 204 4R
FAA RD64 101

Unclassified report

Legibility of this document is in part unsatisfactory. Reproduction has been made from best available copy.

Descriptors: (*Weather forecasting, Data processing systems), (*Wind, Weather forecasting), (*Air traffic control systems, Wind), Upper atmosphere, Meteorological parameters, Harmonic analysis, Programming languages, Input-output devices, Jet streams (Meteorology), Flight paths, Stratosphere, Equations, United States.

The objectives of the research program are classified into (1) data handling, (2) objective analysis, and (3) objective forecasting of parameters characterizing the layer of maximum wind (LMW). Data handling aspects are described. Error checking and harmonic analysis of vertical wind profiles are discussed. Computer programs in FORTRAN for an IBM 7090 are included in an appendix. A method of objective horizontal analysis of LMW parameters is discussed, which is based on the concept of fitting a quadratic function to station observations in order to arrive at grid point data. Machine programs are listed in an appendix. A detailed outline of various approaches to 12 - and 24 - hour kinematic extrapolation forecasts is given. Skill evaluations are presented in comparison to persistence. Various smoothing techniques on input and output have been tested as to their effect in reducing forecasting errors. Forecasting examples are given in the form of tables and graphs. A 25-day period (January 1 through 25, 1961) has been selected to test the more promising techniques of extrapolating LMW parameters. (Author)

AD-604 446 Div. 2, 22
OTS Prices: HC $3.00/MF $0.75

Syracuse Univ., N. Y. Research Inst.
THE USE OF FOAMED PROPELLANTS FOR COMPACTION AND STABILIZATION OF VARIOUS TYPES OF TERRAIN.
Final rept.,
by Louis J. Goodman, Cornelius S. Grove, Jr., and Ardeshir Aidun. Jul 64, 97p CE-974-647F1
Contract AF19 628 492, Proj. 7628, Task 762802
AFCRL 64 622

Unclassified report

Descriptors: (*Propellants, Foams), (*Soil mechanics, Explosion effects), (*Explosive materials, Foams), Hydrazine, Ammonium compounds, Perchlorates, Proteins, Detonation, Shock waves, Soils, Stabilization, Sand, Gravel, Silt, Terrain.

The report describes a proposed new method for compacting soil which is based on the principle of pressure waves as a source of compaction energy. This method which has been termed the foamed propellant method for soil compaction has a formulation containing hydrazine, ammonium perchlorate and a foaming agent, hydrolized protein base foam liquid. The mechanics of this new compaction method are relatively simple, with a blanket of the foamed propellant system placed on the surface of the soil to be compacted and then detonated. The results of using the foamed propellant system to compact both cohesionless and cohesive soils are presented and discussed. This includes some preliminary investigation of the influence of both surface area and multiple detonation on compaction control parameters. The results of this investigation to date show conclusively that this new compaction method is effective in increasing the density of the soil to depths of as much as 15 inches below the surface for sandy soils, sand-gravel mixtures and a predominantly silty soil containing little clay. (Author)

AD-604 450 Div. 2, 12
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
COSPAR INTERNATIONAL REFERENCE ATMOSPHERE,
by H. Kallmann-Biji. Nov 61, 8p P-2474

Unclassified report

Presented at the meeting of the National Academy of Sciences of the Univ. of California in San Diego and Los Angeles, 29 Oct-1 Nov 61.

Descriptors: (*Atmospheric sounding, Upper atmosphere), (*Upper atmosphere, Meteorological parameters), High altitude, Physics, Upper atmosphere, Satellites (Artificial), Geodesics, Geophysics, Solar radiation, Earth, Diurnal variations, Atmospheric temperatures, Scientific research, Scientific personnel, Meteorological satellites, Sounding rockets, Density, Pressure.

The scientific problem of high altitude physics which involves the determination of density, pressure, composition and temperature is discussed. It was found that these properties are not only functions of altitude, but also of local time and position with regard to the surface of the earth. (Author)

AD-604 539 Div. 2
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
NOTE ON THE AGE OF THE EARTH--MOON SYSTEM,
by D. L. Lamar. May 62, 4p P-2551

Unclassified report

Descriptors: (*Geologic age determination, Solar systems), (*Earth, Geologic age determination), (*Moon, Geologic age determination), Astrophysics, Theory.

AD-604 561 Div. 2, 25
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.

AD-604 366 Div. 2, 8
OTS Prices: HC $2.00/MF $0.50

Harvard Coll., Cambridge, Mass. Observatory.
MEASUREMENTS OF RADIO NOISE AT 0.700 MC AND 2,200 MC FROM A HIGH-ALTITUDE ROCKET PROBE.
Technical rept. no. 1,
by G. R. Huguenin, A. E. Lilley, W. H. McDonough, and M. D. Papagiannis. Jul 64, 29p
Contracts AF19 628 3890, AF19 604 6120,
Proj. 8605, Task 860505
AFCRL 64 596

Unclassified report

Descriptors: (*Radio astronomy, Radio interference), (*Extraterrestrial radio waves, Intensity), (*Radio interference, Measurement), Space probes, Rockets, High altitude, Medium frequency, Radiometers, Antennas, Sky brightness, Sources, Ionospheric propagation.

Radio noise observations at frequencies of 0.700 Mc and 2,200 Mc were made at altitudes between 3,000 and 11,000 km from a Blue Scout Jr. high-altitude rocket probe on 30 July 1963. Assuming a galactic origin of the observed fluxes at both frequencies, the averaged sky brightnesses were determined. The observed brightness at 2,200 Mc is in reasonable agreement with the results of other observers. The apparent brightness at 0.700 Mc is, however, greater than was expected from previous observations. An alternative source of the 0.700 Mc flux in the terrestrial exosphere, as well as characteristics of several noise bursts observed during the flight, is briefly discussed. (Author)

AD-604 368 Div. 2
OTS Prices: HC $6.00/MF $1.25

Washington Univ., Seattle.
ON THE STEADY-STATE FLOW OF SEA ICE.
Scientific rept.,
by William Joseph Campbell. Jul 64, 214p
Contract Nonr477 24, Proj. NR307 252

Unclassified report

Descriptors: (*Ice, Oceans), (*Arctic Ocean, Ice), Ice islands, Drift, Ocean currents, Meteorological parameters, Stresses, Marine geophysics, Oceanographic data, Mathematical models, Numerical analysis, Programming (Computers).

The purpose of this paper is to create a model in which the ice and ocean are viewed as a dynamic unit and in which the gradient currents and internal ice stresses are included. Also, this paper is concerned with the solution of such a model.

AD-604 378 Div. 2
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
RELATIONSHIP BETWEEN THE MASSES AND MAGNITUDES OF SMALL METEOROIDS,
by H. K. Kallmann. 8 Jun 54, 35p P-532

Unclassified report

Descriptors: (*Meteors, Physical properties), Particle size, Weight, Light, Intensity, Illumination, Visual signals, Atmosphere, Velocity, Meteorites.

An estimate of the probable masses of meteors of different brightness and velocities was made. Only meteors of relatively small sizes, ranging from about 1 to 0.0001 centimeters in radius were considered. An approximate distinction has been made between meteors of magnitudes larger than plus one and smaller than minus one, in order to account for the various sources of visible radiation predominant for different magnitude or brightness ranges. The time interval over which a meteor of a certain magnitude is visible to an observer was included in the mass calculations. Mass calculations were made for three major showers: the Geminids, the Perseids, and the Leonids; the corresponding average velocities with which particles belonging to these showers enter the earth's atmosphere are about 35 km/sec, 61 km/sec and 71 km/sec respectively. The results show that the determination of meteor masses from the luminosity-magnitude relation is dependent to some degree on the luminous efficiency and on the duration or visible path length.

AD-604 389 Div. 2
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
DIAGRAM OF THE STRUCTURE OF THE UPPER ATMOSPHERE,
by William W. Kellogg. 1 Aug 54, 4p P-554

Unclassified report

Descriptors: (*Upper atmosphere, Physical properties), Atmosphere, Meteorological parameters, Graphics.

The diagram is designed to portray some of the physical features of the upper atmosphere. The ordinate is height (up to 400 km), and the distribution of some important parameters are plotted, accompanied by the levels at which various chemical and physical processes occur. (Author)

AD-604 414 Div. 2, 6
OTS Prices: HC $1.00/MF $0.50

Oceanics, Inc., Plainview, N. Y.
THE APPLICATION OF AIRBORNE RADAR BACKSCATTER TO MEASUREMENT OF THE STATE OF THE SEA,
by Wilbur Matks. Aug 64, 23p Oceanics-64-17
Contract Nonr3961 00

Unclassified report

Descriptors: (*Radar clutter, Ocean waves), (*Ocean waves, Radar reflections), Stereoscopic photography, Statistical data, Ocean models, Water waves, Oceanology, Measurement, Feasibility studies, Airborne, Marine meteorology.

This paper explores the possibility of using radar backscatter from the sea surface as a measure of the waves present. Wave profiles read from stereo-photographs of the waves, obtained on a ship, are reduced to statistics of a kind that may be compared with radar backscatter measured simultaneously. The wave statistics are also compared with model tank data. It appears, from these preliminary experiments, that good correlation can be obtained between wave and radar statistics; the best statistic for correlation remains to be determined. The uniqueness of correlation will depend on further analysis in different states of sea. (Author)

AD-604 432 Div. 2, 8
OTS Prices: HC $2.00/MF $0.50

Ionosphere Research Lab., Pennsylvania State Univ., University Park.
THE MEASUREMENT OF PHASE AND AMPLITUDE RADIO WAVE INTERACTION AT UNIVERSITY PARK, PENNSYLVANIA, FOR JANUARY-FEBRUARY-MARCH, 1964.
Scientific rept. for 1 Jan-31 Mar 64,
by A. J. Ferraro and H. S. Lee. 1 May 64, 42p IRL-207

Diffuziya Meteornykh Sledov; Trans. of Astronomicheskaya Observatoriya, Stalinabad. Byulleten' (USSR) 1952, no. 1, p. 15-26.

Descriptors: (*Meteors, Gas ionization), (*Diffusion, Gas ionization), (*Gas ionization, Meteors), Ions, Recombination reactions, Luminescence, Optical properties, Mathematical analysis, Astrophysics, USSR.

Application of the theory of diffusion to the phenomenon of meteoric trails enables the derivation from astronomical observations of a convenient method for determining the coefficient of diffusion at great altitudes where direct determinations are impossible or unfeasible. Analysis of the numerical magnitude of the coefficient of diffusion confirms the hypothesis of the turbulent nature of diffusion, and also the hypothesis that the coefficient of diffusion is a measure of the vertical mixing of the atmosphere. This mixing is inherent in the atmosphere as such, and is not introduced from outside by a meteoric body; this follows not only from the smallness of the corresponding Reynolds number, but also from the duration of the process of mixing, which does not decline noticeably even after an interval of the order of one hour after the passage of the meteor. In addition to its acknowledged significance in determining the direction and speed of stratospheric currents, observation of meteoric trails is acquiring new geophysical significance as a means of studying vertical mixing. New light is also being shed on the problem of the conditions under which enduring ionized trails of meteors appear. (Author)

AD-604 808 Div. 2, 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
PROLOGUE TO A SYNTAX OF SPACE EXPLORATION,
by A. G. Wilson. 15 Jul 58, 12p P-1425
Unclassified report

Paper read at Lunar and Planetary Exploration Colloquim (2nd), RAND Corp., 15 Jul 58.

Descriptors: (*Space probes, Research program Administration), Space flight, Extraterrestrial topography, Exploration.

A paper concerning the problem of arriving at a unified scientifically responsible program, or syntax, for space exploration.

AD-604 817 Div. 2, 12
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
REVIEW OF 'PROCEEDINGS OF THE INTERNATIONAL METEROLOGICAL SATELLITE WORKSHOP, NOVEMBER 13-22, 1961' U. S. GOVERNMENT PRINTING OFFICE, WASHINGTON, D. C., 1962,
by W. W. Kellogg. Sep 62, 6p P-2635
Unclassified report

Paper prepared for publication in Transactions of the American Geophysical Union.

Descriptors: (*Meteorological Satellites, Symposia), Weather forecasting, Scientific personnel, Reports, Reviews, Meteorology.

The talks, and much of the discussion following the talks, are all included in the Proceedings, along with an Appendix giving further details on how the TIROS system operates. The Proceedings serves as an excellent source book of information on U. S. weather satellites and their use, and a brief description of what the future holds if all goes according to plan.

AD-604 828 Div. 2, 25
OTS Prices: HC $4.00/MF $0.75

Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
INTERFEROMETER STUDY OF THE EFFECTS OF MASS ADDITION BY TRANSPIRATION ON HEAT TRANSFER FROM A VERTICAL PLATE IN FREE CONVECTION.
Master's thesis,
by Darrell A. Schneider. Jun 64, 116p
AFIT GAM/ME/64-17
Unclassified report

Descriptors: (*Heat transfer, Flat plate models), (*Flat plate models, Heat transfer), (*Flow visualization, Interferometers), Fluid flow, Surface temperatures, Heat transfer coefficients, Boundary layer.

A study was made of the effects of transpiration mass addition on heat transfer from a flat plate in steady state free convection. The investigation was conducted using a vertical plate heated to temperatures up to 150F. The effects of low blowing rates on heat transfer were determined by investigating the effects on the surface heat transfer coefficient, the boundary layer temperature profile, and the Nusselt, Prandtl and Grashof number relationship. An interferometer was used to visually observe the boundary layer and to provide a direct means of calculating the heat transfer coefficients and temperature profiles. Blowing was found to greatly reduce the surface heat transfer coefficient and change the boundary layer temperature profile by reducing the surface temperature gradient. This study also indicates that it may be feasible to apply the equation relating Nusselt, Prandtl and Grashof numbers for free convection to include mass addition by transpiration. (Author)

AD-604 852 Div. 2, 15
OTS Prices: HC $3.00/MF $0.75

RAND Corp., Santa Monica, Calif.
POSSIBLE GALACTIC SCALE DISCRETIZATION,
by Dominic G. B. Edelen. Nov 63, 84p RM-3941-RC
Unclassified report

Descriptors: (*Galaxies, Relativity theory), (*Relativity theory, Galaxies), Configuration, Mass-energy relation, Differential geometry, Astrophysics, Mathematical models.

This paper presents the analysis of a class C of quasi-oblate spheroidal galactic structures, the results pertinent to the quasi-spherical structures being a special case. The results are confined primarily to the implications of the eigensequence that delineates the underlying geometric configurations and the corresponding discretization effects.

AD-604 856 Div. 2
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
SELECTED HYGROMETRIC TABLES FOR LOW TEMPERATURES AND PRESSURES,
by M. T. Klappert and G. F. Schilling.
Aug 64, 42p RM-4244-PR
Contract AF49 638 700
Unclassified report

Descriptors: (*Water vapor, Atmosphere), (*Tables, Meteorological parameters), Atmospheric temperature, Barometric pressure, Thermodynamics, Planetary atmospheres, Hygrometers, Meteorology.

Studies of the upper atmosphere of Earth and the atmospheres of other planets require a knowledge of the basic thermodynamic properties of water vapor under low ambient temperatures and pressures. Selected portions

A NOTE ON INFRARED STELLAR MAGNITUDES,
by Lewis Larmore. 13 Oct 54, 10p P-581
Unclassified report

Descriptors: (*Infrared spectroscopy, Stars), (*Stars, Infrared spectroscopy), Lead compounds, Sulfides, Detectors, Blackbody radiation, Colors, Astrophysics, Visual perception, Correlation techniques.

The luminous efficiencies of the eye and a lead sulphide detector have been computed for black-body radiation over the range of temperatures from 300K to 25,000K. The ratio of these efficiencies is used to compute the infrared color index of stars from type M to type B of the spectral series; the infrared color index is here defined as the visual magnitude minus infrared magnitude, with the difference adjusted to give zero for type AO stars. The computed values of the infrared color indices are compared with those measured by Fellgett, and surprisingly good agreement is obtained. The greatest discrepancy is found for B-type stars. The discrepancies are discussed for particular stars. (Author)

AD-604 594 Div. 2, 12, 30
OTS Prices: HC $3.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A POSSIBLE APPROACH TO SCIENTIFIC EXPLORATION OF THE PLANET MARS,
by E. A. Steinhoff. 12 Jan 62, 56p
Unclassified report

Descriptors: (*Mars probes, Feasibility studies), (*Space probes, Mars), Spacecraft, Space propulsion, Closed ecological systems, Space stations, Extraterrestrial bases, Astronautics, Extraterrestrial topography, Exploration.

This paper deals with some possible objectives of a Mars expedition, operational approaches that promise early feasibility, and their technological foundation. It does not deal with specific solutions optimized for minimum objectives, but with ways to obtain a foothold for a scientific team, and to support it continuously, the aim being to achieve increasing self-sufficiency in the later phases of the establishment of a Mars base.

AD-604 657 Div. 2
OTS Prices: HC $2.00/MF $0.50

Iowa State Univ., Iowa City.
MEASUREMENTS OF ENERGETIC ELECTRONS IN THE VICINITY OF THE SUNWARD MAGNETOSPHERIC BOUNDARY WITH EXPLORER XIV,
by L. A. Frank and J. A. Van Allen. Aug 64, 37p
SUI-64-20
Contract Nonr1509 06, Grant NsG233 62
Unclassified report

Descriptors: (*Upper atmosphere, Electrons), (*Plasma medium, Upper atmosphere), Electron density, Periodic variations, Terrestrial magnetism, Van Allen radiation belt, Scientific satellites.

Observations with the satellite Explorer XIV to radial distances of 16RE (earth radii) on the generally sunward side of the earth establish the mean geocentric radial distance of the magnetospheric boundary near the sun-earth line as approx. 11RE during May-August 1963. Isolated 'spikes' of electrons were often but not always observed in a transition region of radial thickness 2 to 3 RE beyond the magnetospheric boundary. The geocentric radial distances of both the magnetospheric boundary and the outer boundary of the transition region increase with increasing angle from the sun-earth line toward local evening and the latter boundary apparently lies beyond 16RE on the local sunset meridian. Electrons of energies exceeding 1.6 MeV were observed in localized 'hot spots' in the transition region near local morning, implying further heating of electrons in the solar plasma as it flows around the magnetosphere.

AD-604 758 Div. 2
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE INFLUENCE OF WEAK ATMOSPHERIC INHOMOGENEITIES UPON THE PROPAGATION OF SOUND AND LIGHT,
by A. Obukhov. 28 Jul 55, 22p T-47
TT 64 71252
Unclassified report

[O Vliyanii Slabykh Neodmorodnostei Atmosfery na Rasprostranenie Zvuka i Sveta]; trans. of Akademiya Nauk SSSR. Izvestiya. Seriya Geofizicheskaya, 1953, no. 2, p. 155-165.

Descriptors: (*Sound, Propagation), (*Atmosphere, Physical properties), (*Light, Propagation), Stars, Acoustics, Atmospheric motion, Atmospheric refraction, Refractive index, Diffraction, Mathematical analysis, USSR.

The problem of wave propagation in a medium with fluctuating refractive index is considered, this problem being of interest from the standpoint of the theory of twinkling of stars and atmospheric acoustics. The problem is reduced to linearized equations satisfied by the phase and logarithmic amplitude of the propagating wave. Limiting cases are investigated and particular examples are considered to indicate the limits of validity of the geometric optics treatment and the nature of the corrections required to take account of diffraction effects. (Author)

AD-604 769 Div. 2, 7, 13, 20
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ATOMIC DEVELOPMENTS IN THE SOVIET UNION: AN ATOMIC INDUSTRY PROJECT AT ANGARA, SIBERIA [AND] URANIUM DEPOSITS IN THE SOVIET UNION. (TWO GERMAN NEWS ITEMS).
22 Apr 55, 8p T-43
TT 64 71263
Unclassified report

Trans. from Wehrtechnische Hefte (West Germany) 1955, Feb.

Descriptors: (*Nuclear power plants, Siberia), (*Uranium, USSR), Ores (Metal sources), Ores (Nonmetallic), Geology, Geography, Industries, Electric power production, Transportation, Reports, West Germany.

Two reports on an atomic industry project at Angara, Siberia, and on uranium deposits in the USSR are presented.

AD-604 786 Div. 2
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
DIFFUSION OF METEORIC TRAILS,
by O. V. Dobrovol'skii. 22 Nov 54, 24p T-39
TT 64 71280
Unclassified report

AD-604 961 Div. 2
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
SYNOPTIC WEATHER OBSERVATIONS FROM EXTREME ALTITUDES,
by S. M. Greenfield. 15 Feb 56, 14p P-761
Unclassified report

Presented at the American Meteorological Society meeting in New York, 23 Jan 56.

Descriptors: (*Weather forecasting, Cloud cover), Theory, Meteorological satellites, Photographs, Meteorology.

AD-604 966 Div. 2
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
CLIMATOLOGY: COMPLEX, DYNAMIC, AND SYNOPTIC,
by Arnold Court. 22 Nov 55, 30p P-769
Unclassified report

Descriptors: (*Climatology, Weather forecasting), (*Weather forecasting, Climatology), Meteorological parameters, Meteorological phenomena, Air mass analysis.

Origins, definitions, applications, and uses of three aspects of modern climatology (dynamic synoptic, and complex) are offered in this note. A survey of existing methods of climatic analysis was undertaken in an effort to sharpen the definitions in a Glossary of Meteorology being prepared by the American Meterological Society.

AD-604 977 Div. 2
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE IMPACT THEORY OF THE ORIGIN OF LUNAR CRATERS,
by J. J. Gilvarry and J. E. Hill. 4 Jan 56, 10p
P-785
Unclassified report

Descriptors: (*Moon, Cratering), Lunar environment, Theory, Impact shock, Meteorites, Equations of state, Astrophysics.

The purpose of this paper is to present the results of computations on the pressures and temperatures attained in the impact of large meteorites on the lunar surface, based on the equation of state as obtained from the Thomas-Fermi statistical model of the atom.

AD-605 019 Div. 2
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
PHYSICAL PROPERTIES OF THE ATMOSPHERE FROM 90 TO 300 KILOMETERS. PROPOSED 'SPECULATIVE ATMOSPHERE' SUBMITTED TO THE WORKING GROUP ON EXTENSION TO THE U. S. STANDARD ATMOSPHERE TABLES,
by H. K. Kallmann, W. B. White, and H. E. Newell, Jr.
Feb 56, 28p P-835
Unclassified report

Descriptors: (*Atmosphere models, Physical properties), Oxygen, Nitrogen, Dissociation, Density, Exosphere, Ionosphere, Atmosphere temperature, Barometric pressure, Standards.

An average model atmosphere is presented for the region between 90 and 300 km. This model is consistent with or depends on the following assumptions: molecular oxygen begins to dissociate appreciably only above 90 km; at around 130 km about 30 per cent of 02 is still in the undissociated state; molecular nitrogen begins to dissociate above 220 km; the concentration of molecular oxygen and nitrogen decreases with altitude exponentially; the temperature becomes isothermal in the region of the exosphere, approximately above 360 km. All physical quantities were calculated from self-consistent equations as continuous functions of altitude, without assuming any particular form of the temperature gradient. The results show lower temperatures and densities throughout the region of the ionosphere than have been deduced previously. (Author)

AD-605 020 Div. 2
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE IMPACT OF LARGE METEORITES,
by J. J. Gilvarry and J. E. Hill. 3 Apr 56, 34p
P-836
Unclassified report

Descriptors: (*Meteorites, Impact shock), Shock waves, Moon, Earth, Pressure, Temperature, One-dimensional flow, Mathematical analysis, Equations of state.

The impact of large meteorites on the moon or earth is discussed, on the basis of a one-dimensional idealization of the flow problem in which a plane shock wave in both meteorite and impact surface is considered. Conditions are discussed under which such a model can yield physically valid estimates of pressure and temperature generated on explosive impact of meteorites. Computations are carried out for an equation of state and internal energy from the statistical Thomas-Fermi atom model; departures from complete degeneracy are taken into account by means of results of a first-order perturbation with respect to temperature.

AD-605 047 Div. 2
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
TEMPERATURES IN THE EARTH'S INTERIOR,
by J. J. Gilvarry. 6 Jun 56, 22p P-875
Unclassified report

Descriptors: (*Earth, Temperature), Geophysics, Theory, Equations of state, Mathematical prediction, Melting, Equations.

Fusion temperatures are evaluated for the earth's mantle from Lindemann's law, by use of elastic parameters determined for a given depth from seismic data. The results are substantially consistent with prediction from the Simon equation, on the basis of a theoretical evaluation of the Simon exponent. The same formulation of the Simon equation is used to obtain fusion temperatures for the core. No inconsistency with these values is shown by deductions from Lindemann's law for the outer core. The melting temperatures found for the core are considerably higher than those predicted by Simon or Bullard, and show no substantial conflict with Jacobs' hypothesis on the origin of a solid inner core. By using data on the temperature in the earth at small depth, and limits imposed on the possible values by melting temperatures at large depth, the actual temperature in the earth is represented approximately by a quartic polynomial in the depth; the limit of error at large depth if the inner core is solid estimated as ± 25 percent. (Author)

of the Smithsonian hygrometric tables have been extended through machine computations to meet this demand. The principal results are presented in easily usable form. In the first two tables is a tabular listing of the saturation water-vapor pressure over ice between temperatures of 100K and 200K. In the third table are listed the saturation mixing ratios of water vapor over ice between 125K and 270K for atmospheric pressures ranging from 700 mb to 10-5 mb. Finally, tabular and graphical presentations of saturation water-vapor pressures and mixing ratios are given for the 1962 U. S. Standard Atmosphere to an altitude of 99 km. (Author)

AD-604 880 Div. 2
OTS Prices: HC $6.00/MF $1.50

Air Force Cambridge Research Labs., Bedford, Mass.
OZONESONDE OBSERVATIONS OVER NORTH AMERICA, VOLUME 2,
ed. by Wayne S. Hering and Thomas R. Borden, Jr.
Jul 64, 296p
AFCRL 64 30 P2, AFCRL ERP38

Unclassified report

Descriptors: (*Ozone, Atmosphere), North America, Distribution, Measurement, Meteorological instruments, Data, Graphics.

An experimental program for the measurement of the vertical ozone distribution was initiated by the Air Force Cambridge Research Laboratories in January 1963. A network of eleven ozonesonde stations was established in North America to provide high resolution observations of the vertical ozone distribution for a variety of research purposes. The resultant data are published in a series of reports. The first volume (AD-435 873) contained the ozonesonde and associated radiosonde observations for the months of December 1962 through March 1963. This second volume contains the ozonesonde and associated radiosonde observations for the months of April through August 1963. Also included in Volumn 2 are the average distributions of ozone over the North American continent as derived from the network observations. Data averages for overlapping bimonthly periods are presented for January-February through July-August 1963. (Author)

AD-604 881 Div. 2, 30
OTS Prices: HC $5.00/MF $1.00

Iowa Engineering Experiment Station, Ames.
FAST RESPONSE INSTRUMENTATION FOR THE MEASUREMENT OF TURBULENT FLUXES IN THE LOWER ATMOSPHERE AND A FILM READER SYSTEM AND ANALOG STATISTICAL ANALYZER.
Final rept.,
by Robert M. Stewart, Jr., Robert E. Post, J. Ralph Edwards, Robert W. Johnson, and James H. Tracey.
1 Feb 64, 192p
Contract AF19 604 5457, Projs. 7655, 8604,
Tasks 765502, 860401
AFCRL 64 147

Unclassified report

Descriptors: (*Hygrometers, Design), (*Anemometers, Design), (*Film readers, Design), (*Micrometeorology, Instrumentation), Analog systems, Correlators, Spectrum analyzers, Wave analyzers, Turbulent boundary layer, Measurement.

The goal of the research was to develop rapid reponse instrumentation suitable for the measurement of the turbulent fluxes of momentum, heat, and water vapor in the boundary layer. The instrumentation selected and developed for the measurement of mass transport and temperature was a gated continuous-wave two-head sonic anemometer. An infrared technique was developed to measure specific humidity over a one-meter open path. In order to establish the specifications for these two instruments so that they would be compatible with the flux calculations to be undertaken, a careful study and error analysis was made of the flux calculations. The analysis was directed both toward the determination of tolerance limits on the instruments and the development of efficient programs of calculation. The development of a film reader which can be used in the analog processing of fluctuation data to extract statistical properties is also discussed.

AD-604 941 Div. 2, 25
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
LINE WIDTH PROBLES IN HOT DENSE ATMOSPHERES,
by Roland Meyerott. 6 Sep 55, 14p P-732

Unclassified report

Descriptors: (*Line spectrum, Planetary atmospheres), (*Quantum mechanics, Astrophysics), (*Astrophysics, Planetary atmospheres), Temperature, Electrons, Ions, Hydrogen, Electrostatics, Plasma physics.

Line width problems as they arise under conditions of temperature and density such as are found in stellar interiors are discussed. Possibilities of experimental verification are briefly considered. (Author)

AD-604 942 Div. 2, 12
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
SCIENTIFIC USE OF AN ARTIFICIAL SATELLITE,
by H. K. Kallmann, W. W. Kellogg, R. R. Rapp, and S. M. Greenfield. 6 Sep 55, 24p P-733

Unclassified report

Descriptors: (*Satellites (Artificial), Scientific research), (*Scientific satellites, Geophysics), Solar radiation, Electron density, Atmosphere, Cosmic rays, Meteors, Terrestrial magnetism, Artificial precipitation, Geodesics, Albedo (Astronomy), Extraterrestrial radio waves.

AD-604 960 Div. 2, 12
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
USE OF AN ARTIFICIAL SATELLITE IN UPPER AIR RESEARCH,
by H. K. Kallmann and W. W. Kellogg. 15 Feb 56,
14p P-760

Unclassified report

Presented at the National Meeting of the American Meteorological Society held in New York, 23 Jan 56.

Descriptors: (*Satellites (Artificial), Astronomical geodesics), (*Astronomical geodesics, Satellites (Artificial)), (*Geodesics, Satellites (Artificial)), Upper atmosphere, Ionosphere, Electron density, Solar radiation, Cosmic rays, Meteors, Meteorites, Meteorology, Gravity, Terrestrial magnetism, Sounding rockets.

The principal fields of study and the important knowledge that can be gained from observations made from a satellite involved in the International Geophysical year program are presented.

3. Chemical Warfare Equipment and Materials

AD-604 595 Div. 3
OTS Prices: HC $1.00/MF $0.50

American Air Filter Co., Inc., Louisville, Ky.
FEASIBILITY STUDY OF COLLECTIVE PROTECTION FOR COMMAND POST VEHICLES.
Monthly progress rept. no. 1, 1-31 Jul 64.
17 Aug 64, 13p
Contract DA18 035AMC275A

Unclassified report

Descriptors: (*Air pollution, Vehicles), (*Vehicles, Decontamination), Feasibility studies, Design, Contamination, Pressure, Air conditioning equipment, Test equipment.

First month work consisted of preliminary meetings with CRDL; literature search of state-of-the-art concepts at CRDL Library; vehicle access arrangements made at Fort Knox, Ky. and CRDL; preliminary air flow test on air lock; design and fabrication of leakage test apparatus and adapters; U. S. Government Property Manual, prepared, submitted and approved by Government Property Administrator. (Author)

AD-604 823 Div. 3, 4, 16
OTS Prices: HC $3.00/MF $0.75

Melpar, Inc., Falls Church, Va.
NONLABELLED COMPOUNDS FOR RESEARCH APPLICATION.
Final rept. for 27 Jun 63-1 Jul 64,
by J. M. Augl, L. M. Kndley, and H. E. Podall.
Aug 64, 98p
Contract DA18 108AMC242A

Unclassified report

Descriptors: (*Chemical warfare agents, Therapy), Drugs, Synthesis (Chemistry), Physical properties, Chemical reactions.

Fifty-seven compounds were prepared and characterized, of which twenty-eight were delivered. None of the compounds delivered were commercially available. In some instances the method of preparation and the physical constants are reported in the literature, while in other cases analogous procedures were applied to the synthesis of the desired compounds. A number of new compounds were prepared which required research effort to develop a satisfactory synthesis route. The synthesis of a number of new compounds was started, but further research and development effort is required to obtain final results. The research on these compounds to date is discussed along with proposed routes for the synthesis of model compounds. (Author)

AD-605 054 Div. 2, 12
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
DETAILED ANALYSIS OF SYNOPTIC WEATHER AS OBSERVED FROM PHOTOGRAPHS TAKEN ON TWO ROCKET FLIGHTS OVER WHITE SANDS, NEW MEXICO, JULY 26, 1948,
by J. Bjerknes. 1 Apr 51, 26p P887
Unclassified report

Descriptors: (*Aerial photographs, Atmospheric sounding), (*Meteorology, Cloud cover), (*Sounding rockets, Aerial photographs), (*Cloud cover, Aerial photographs), Meteorological charts, Cumulus clouds, Stratus clouds, Cirrus clouds, Cumulonimbus clouds, Anticyclones, Wind, Air mass analysis.

It is shown that rocket pictures add a considerable amount of interesting information to the ordinary weather-map analysis, and in addition, that the accumulated knowledge from the maps helps in the new problem of interpreting what is seen from high-level rocket pictures.

AD-605 061 Div. 2
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ATMOSPHERIC TRANSMISSION,
by Sidney Passman and Lewis Larmore. 11 Jul 56, 20p P-897
Unclassified report

Descriptors: (*Infrared radiation, Atmosphere), (*Atmosphere, Wave transmission), Water vapor, Absorption, Tables.

Values of the water vapor error function absorption coefficients are given for infrared radiation in the wavelength region from 1.4 microns to 5.9 microns. These values correct the data of L. Larmore IRIS Proceedings, Vol. I, No. 1, p. 14, so as to agree with the implications of certain subsequent experimental data. The resultant actual transmission values were recalculated for these revised coefficients for various amounts of precipitable water vapor and are given as a function of wavelength in the 1.4 to 5.9 micron region in 0.1 micron intervals.

AD-605 071 Div. 2
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A SYSTEMATIC APPROACH TO LOCAL OBJECTIVE FORECAST STUDIES,
by J. Doyne Sartor. 27 Jun 57, rev. 22 Nov 57, 26p P-912
Unclassified report

Descriptors: (*Weather forecasting, Standards), (*Meteorology, Standardization), Meteorological parameters, Meteorological charts, Climatology, Reliability, Operation, Errors.

Problems in the design, preparation, and use of local objective forecasting studies were evaluated while specific local objective forecasting studies were being made. As a result, a systematic procedure that may be used as a guide in designing and preparing local objective forecasting studies was developed and tested in a number of seminar-workshop groups. The systematic procedure is outlined and discussed with illustrations from several local objective forecasting studies. The procedure consists of defining the local forecasting problem in terms consistent with observing and forecasting capabilities, resolving the variability of the forecast element into its cyclic (seasonal and diurnal) and 'synoptic' components, and finally, reassembling the components into a forecast scheme that allows the forecaster to exercise his training as a meteorologist. (Author)

AD-605 102 Div. 2, 9
OTS Prices: HC $3.00/MF $0.75

RAND Corp., Santa Monica, Calif.
METEORIC INTERACTION WITH THE ATMOSPHERE; THEORY OF DRAG AND HEATING AND COMPARISON WITH OBSERVATIONS,
by Carl Gazley, Jr. Aug 59, 78p P-953
Unclassified report

Paper presented at the Air Force Symposium on High Speed Aerodynamics, Buffalo, N. Y. Jan 56; and at the Rand Symposium on Aerodynamics of the Upper Atmosphere, Jun 59, and pub. as chap. 6 of its proceedings.

Descriptors: (*Meteors, Atmosphere entry), (*Atmosphere entry, Meteors), Aerodynamic characteristics, Drag, Aerodynamic heating, Ablation, Deceleration, Superaerodynamics.

The entry of meteoroids into the earth's atmosphere involves velocities higher than presently available in any terrestrial laboratory facility. While meteoric interaction with the atmosphere obviously does not provide a controlled type of experiment and many of the test conditions must be deduced indirectly, it offers the opportunity of aerodynamic data at extreme velocities and altitudes. Extensive observations of meteor velocity, luminosity, and altitudes, together with atmospheric-density observations, now enable certain deductions to be made about the aerodynamic drag and heating. Comparison is made between meteor theory and observations in an attempt to obtain information about the mechanisms of aerodynamic drag, aerodynamic heating, and surface ablation. General analytical expressions are developed for meteoroid deceleration, mass loss, and luminosity. The results of this analysis are expressed in terms of the observational quantities and compared with the more reliable measurements. This comparison indicates that the extension of conventional free-molecule aerodynamics to the meteor case appears to be justified. (Author)

AD-604 494 Div. 4, 25
OTS Prices: HC $2.00/MF $0.50

Cornell Univ., Ithaca, N. Y.
AN ELECTRIC FIELD EFFECT ON THE CRITICAL OPALESCENCE.
Technical rept. no. 9,
by P. Debye and K. Kleboth. 15 Sep 64, 32p
Contract Nonr401 17, Proj. NR051 360
Unclassified report

AD-408 322

Descriptors: (*Liquids, Optical properties), (*Electric fields, Liquids), Light, Scattering, Intensity, Theory, Temperature, Dielectric properties, Thermodynamics, Nitrobenzenes, Aliphatic compounds.

The free energy involved in the concentration fluctuations of a liquid mixture is changed by an electric field. The effect becomes observable near the critical point. It increases with decreasing distance from the critical temperature and it is proportional to the square of the field intensity and to the second derivative of the dielectric constant with respect to the concentration. The effect can be interpreted as a shift of the critical temperature. Experiments performed with a field intensity of 45 000 Volts/cm on the system nitrobenzene -2,2,4-trimethyl pentane give a value of .015 degrees for this shift, while the theory predicts .010 degrees. Also in good agreement with the theory is the dependence on the field intensity and on the temperature distance from the critical temperature. (Author)

AD-604 521 Div. 4
OTS Prices: HC $1.00/MF $0.50

Oregon State Univ., Corvallis.
IMPROVED SYNTHESES OF TRIFLUOROMETHYLMERCURIC IODIDE AND METHYLMERCURIC IODIDE.
Technical rept. no. 2,
by David Oehling, Linda Schuerman, John Young, and Theran Parsons. 20 Aug 64, 5p
Contract Nonr1286 04, Proj. NR052 392
Unclassified report

Descriptors: (*Metalorganic compounds, Mercury compounds), (*Mercury compounds, Synthesis (Chemistry)), Fluorine compounds, Iodides, Laboratory equipment, Ultraviolet radiation.

A device was constructed and used for the synthesis of trifluoromethylmercuric iodide, CF_3HgI, and methylmercuric iodide, CH_3HgI, in nearly quantitative yields. Previous synthetic methods for trifluoromethylmercuric iodide have required reaction times of 7-8 days to achieve 50% reaction or have given relatively low yields of product. Yields of methylmercuric iodide are also higher than those reported from the reaction between mercury and a solution of methyl iodide, and reactions of mercury salts with methyl iodide in solution. (Author)

AD-604 522 Div. 4, 25
OTS Prices: HC $1.00/MF $0.50

Oregon State Univ., Corvallis.
ALL METAL SEALED GAS INFRARED CELL.
Technical rept. no. 3,
by John D. Hansen and Theran D. Parsons.
20 Aug 64, 4p
Contract Nonr1286 04, Proj. NR052 392
Unclassified report

Descriptors: (*Infrared spectroscopy, Spectrum analyzers), (*Spectrum analyzers, Infrared radiation), Infrared optical equipment, Gases, Boron compounds, Fluorides, Spectra (Infrared).

An all metal sealed gas cell for the determination of infrared spectra of reactive gases was devised. The cell is inert to boron-fluorine compounds and to other non-oxidizing gases. (Author)

AD-604 558 Div. 4, 14
OTS Prices: HC $1.00/MF $0.50

Naval Research Lab., Washington, D. C.
SOLUBILIZATION OF POLAR SPECIES BY MICELLE-FORMING SOAPS IN A NONPOLAR SOLVENT.
Interim rept.,
by Samuel Kaufman. 31 Jul 64, 10p
Proj. RR001 01 43 4750
NRL 6122
Unclassified report

Descriptors: (*Soaps, Solubility), (*Sulfonates, Solubility), Sodium compounds, Magnesium compounds, Organic solvents, Ethers, Ketones, Amines, Acetates, Chromatographic Analysis.

The solubilization of diethyl ether, acetone, n-propylamine, and methyl acetate by sodium and magnesium dinonylnaphthalene sulfonates in toluene solution was studied by gas-liquid chromatography. Results are compared with data for the solubilization of methanol and acetic acid. Of the solubilizates studied, all were less extensively solubilized than methanol. Within the scope of the data, n-propylamine and acetic acid were solubilized approximately equally by the magnesium soap, but the sodium soap solubilized the acid more vigorously than the amine. The ether and detone were only faintly solubilized and the ester occupied an intermediate position. The data are consistent with conclusions derived from earlier studies of micelle formation and solubilization by the same soaps. At very dilute concentrations of solubilizate, the cation of the soap controls the interaction, but with increasing concentrations, after the coordinating tendency of the cation is satisfied. the anion is the effective moiety. (Author)

AD-604 688 Div. 4, 14, 25
OTS Prices: HC $2.00/MF $0.50

Air Force Materials Lab., Research and Technology Div., Wright-Patterson AFB, Ohio.
INFRARED SPECTRA OF TRANSITION METAL ALKOXIDES.
Rept. for Feb 63-Feb 64,
by C. T. Lynch, K. S. Mazdiyasni, J. S. Smith, and W. J. Crawford. May 64, 42p
Proj. 7350, Task 735001
ML TDR64 124
Unclassified report

Descriptors: (*Metalorganic compounds, Spectra (Infrared)), (*Infrared spectroscopy, Metalorganic compounds), Transition elements, Zirconium compounds, Hafnium compounds, Thorium compounds, Titanium compounds, Yttrium compounds, Organic oxygen compounds, Chemical bonds, Absorption spectrum, Oxides, Refractory materials, Vapor plating.

The infrared spectra of a number of transition metal isopropoxides and tetra tertiary butoxides were obtained from 5000 cm-1 to 285 cm-1 for the first time. The spectra were compared to existing infrared data on these classes of compounds. Characteristic absorptions for the isopropoxy group have been found at 1160 to 1175 cm-1 and at 1120 to 1140 cm-1. They are assigned to isobranching vibrations. The isopropoxides exhibit a doublet at about 1375 cm-1

4. Chemistry

AD-604 345 Div. 4, 3, 25
OTS Prices: HC $2.00/MF $0.50

Southwest Research Inst., San Antonio, Tex.
A BASIC STUDY OF THE SOLUBILITY OF SOLIDS IN GASES AT HIGH PRESSURES.
Final rept. for 7 Jul 63-6 Jul 64,
by Judith Eisenbeiss. 6 Aug 64, 46p
Contract DA18 108AMC244A, Proj. 01 1392
Unclassified report

Descriptors: (*Aromatic compounds, Solubility), (*Polycyclic compounds, Solubility), (*Aerosols, Preparation), Solids, Solvents, Gases, Alkenes, Aliphatic compounds, Methane, Carbon dioxide, Carbon tetrachloride, High-pressure research, Phase studies.

The solubility of phenanthrene in gaseous ethylene, ethane, methane, carbon dioxide and carbon tetrafluoride in the pressure range of 2000 to 8000 psi at 40C was determined experimentally. It was found that the solubility as a function of pressure changes nonlinearly for C2H4, C2H6 and CO2, the incremental solubility decreasing with increasing pressure. The dissolving power of the various gases tends to be in the following order: C2H4> C2H6> CO2> CH4> CF4. A static equilibrium arrangement was used. The saturated gaseous phase was analyzed for its content of phenanthrene by decompressing from equilibrium pressure, capturing the precipitated solid by a condensation trap, measuring the expanded gas volume at atmospheric pressure and room temperature, and weighing the precipitated solid directly. Mercury served as the compressing fluid; its solubility in the gases was considered to be negligible under the conditions of the experiments. (Author)

AD-604 347 Div. 4
OTS Prices: HC $1.00/MF $0.50

Texaco Experiment, Inc., Richmond, Va.
INVESTIGATION OF THE DISSOCIATION CHEMISTRY OF -NF2 COMPOUNDS.
Quarterly rept. for May-Jul 64,
by U. V. Henderson, P. L. Goodfriend, and H. P. Woods.
6 Aug 64, 5p EXP-TM1562, EXP-452(223)
Unclassified report

Descriptors: (*Nitrogen compounds, Fluorides), (*Fluorides, Dissociation), Oxidizers, Free radicals, Absorption spectrum, Photochemistry, Heaters.

The work was a continuation of the search for the electronic-absorption spectrum of the NF radical that is produced by flash photolysis of NF2 (See AD-439 527). A cell that heats the samples to 180C was constructed; however, the use of this has not solved the problem of excessive N2F4 absorption. Consideration was given to alternative approaches to the problem. (Author)

AD-604 433 Div. 4
OTS Prices: HC $2.00/MF $0.50

National Research Corp., Cambridge, Mass.
HEAT OF FORMATION OF BORON TRICHLORIDE (BC13).
Special rept.,
by Ludwig G. Fasolino. 15 Jul 64, 27p
Contract Nonr3608 00
Unclassified report

Descriptors: (*Boron compounds, Chlorides), Hydrolysis, Calorimeters, Thermistors, Calibration, Oxides, Halides, Temperature, Energy, Equations, Heat of formation.

The heat of solution of BC13 (liq.) was determined calorimetrically in a closed reaction vessel. The process was carried out adiabatically. From this value and the heats of formation data of the products and water, the heat of formation of BC13 (liq.) was calculated.

AD-604 474 Div. 4, 30
OTS Prices: HC $1.00/MF $0.50

Lund Univ. (Sweden).
THERMAL STABILITY OF ORGANIC COMPOUNDS.
Technical rept.
by Stig Sunner. 15 Apr 64, 20p
Grant AF EOAR62 110
AFOSR 64 1447
Unclassified report

Descriptors: (*Butanols, Stability), (*Organic compounds, Thermochemistry), (*Laboratory equipment, Design), Pyrolysis, Chromatographic analysis, Alcohols, Calorimeters, Thermal insulation, Heat transfer, Electric connectors, Resistance therometers, Heaters.

One flow and one static pyrolysis apparatus directly attached to a gas chromatograph through a gas sample valve was built and their performance was studied using the four butanols as test substances. A second static pyrolysis apparatus was developed and was partly assembled. Studies were started on the use of a novel principle for building up a thermal shield for adiabatic calorimetry over a wide temperature range. It is based on the use of microconductors consisting of an inner conductor insulated with magnesia within an outer thin-walled metal tube, 0.25 - 1.00 mm in diameter. The mass of the shield consists almost entirely of the leads. The use of two types of microconductors is presently being investigated - one with platinum wire serving as a resistance thermometer and the second with chromel, to be used as a heater. (Author)

AD-604 493 Div. 4
OTS Prices: HC $2.00/MF $0.50

Gibbs Chemical Lab., Harvard Univ., Cambridge, Mass.
THE OXIDATION REACTIONS OF ACETYLENE AND METHANE,
by G. P. Glass, G. B. Kistiakowsky, V. Mitchell, and H. Niki. Aug 64, 32p
Contract Nonr1866 36
Unclassified report

Descriptors: (*Aliphatic compounds, Oxidation), (*Methane, Oxidation), Shock waves, Mass spectroscopy, Luminescence, Reaction kinetics, Ionization, Molecular structure.

The high temperature oxidation reactions of acetylene and methane were studied in shock waves using two techniques. A time-of-flight mass spectrometer was used to determine the concentration of reactants, intermediates and products at 50 microsec. intervals throughout the reaction. In another apparatus the chemiluminescent radiation emitted by CH and C2 and the ionization accompanying the oxidation was monitored. The oxidation of acetylene proceeds by fast chain branching reactions. The oxidation is accompanied by chemi-ionization. The C3H3+ion was observed in abundance early in the reaction. A cyclic structure is proposed for this ion. The oxidation of methane is characterized by an induction period which is followed by fast chain branching reactions. A mechanism involving a straight chain reaction to produce an intermediate which itself takes part in chain branching reactions is suggested. (Author)

5. Communications

AD-604 344 Div. 5, 8, 18
OTS Prices: HC $5.00/MF $1.00

RCA Defense Electronic Products, New York.
STUDY AND APPLICATION OF ADAPTIVE COMMUNICATION TECHNIQUES IN THE DEFENSE COMMUNICATION SYSTEM.
Rept. no. 2.
5 Aug 64, 171p CR64 419 10
Contract DCA6, Proj. 40500AR, Task 40502AR
Unclassified report

Rept. on System Adaptive Techniques.

Descriptors: (*Adaptive communication systems, Defense systems), (*Data transmission systems, Defense systems), High frequency, Multipath transmission, Ionospheric propagation, Pulse communication systems, Attenuation, Distortion, Radio interference, Noise (Radio), Propagation, Errors, Equations, Communication equipment, Transmission lines.

This report concerns adaptive techniques for use in submarine cable, HF, and land-line digital links of the DCS for the period 1970-1975. The overall objective is to devise adaptive data systems which maintain a desired quality of transmission in terms of bit-error-rate under variable conditions of transmission at given, fixed input bit-rates and is directed to adaptive control of the data channel in distinction to control of the data source. The report covers the HF phase of study and work on adaptive anti-distortion systems. Related studies are presented on error-rate in the presence of distortion and noise, pulse response of an FDM stage, and extrapolation of channel frequency response from measurements over a finite band.

AD-604 427 Div. 5, 12, 30
OTS Prices: HC $3.00/MF $0.75

Radio Science Lab., Univ. of Michigan, Ann Arbor.
RESEARCH AND DEVELOPMENT OF AN SFM DATA CORRELATOR.
Final rept. for Jul 63-May 64,
by D. R. Brundage, E. K. Holland-Moritz, and J. C. Dute. Aug 64, 92p IST-5751-11-F
Contract AF33 657 11465, Proj. 4107, Task 410715
AL TDR64 161
Unclassified report

Descriptors: (*Correlators, Space communication systems), (*Space communication systems, Correlators), Data processing systems, Analog-digital computers, Space environmental conditions, Signal generators, Microwave relay systems, Telemeter systems, Matched filters, Input-output devices, Feasibility studies, Aerospace craft, Frequency modulation, Phase distortion, Analog-to-Digital converters, Optical equipment, Noise.

A feasibility model of an SFM data correlator has been constructed which performs the discrete equivalent of the correlation integration required at the receiving terminal of a PCM/SFM communication system. Techniques which lend themselves to miniaturization were used in designing the model so that the correlator would be practicable in an aerospace environment. The correlator is all-electronic and uses a hybrid computer with a digital shift register and analog multipliers. Data rates from d-c to 200,000 bits/sec are possible. Construction details are given and a brief discussion of signal design is included. Preliminary testing indicates that the correlator operates as expected. If a generator can be acquired, then extensive testing and experimenting can be done. (Author)

AD-604 514 Div. 5, 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ON COMMUNICATION PROCESSES INVOLVING LEARNING AND RANDOM DURATION,
by Richard Bellman and Robert Kalaba.
8 Oct 57, 6p P-1194A
Unclassified report

Descriptors: (*Communication systems, Dynamic programming), (*Dynamic programming, Communication systems), Decision theory, Stochastic processes, Learning, Computer storage devices, Probability.

The fundamental problem of determining the utility of a communication channel in conveying information is viewed as a problem within the framework of multistage decision processes of stochastic type, and as such is treated by the theory of dynamic programming. The relations between utility and capacity, in Shannon's sense, are indicated. Treatment of communication problems involving the use of a channel whose properties are not completely known, and those involving processes of random duration, are shown. Treatments of general processes in a uniform fashion by the functional equation technique of dynamic programming are discussed. (Author)

AD-604 526 Div. 5, 8, 30
OTS Prices: HC $6.00/MF $1.50

RCA Defense Electronic Products, Camden, N. J.
SPEECH RECOGNITION BY FEATURE-ABSTRACTION TECHNIQUES.
Interim rept., for May 63-Jun 64,
by T. B. Martin, A. L. Nelson, and H. J. Zadell.
Aug 64, 290p
Contract AF33 657 11535, Proj. 4335, Task 433521
AL TDR64 176
Unclassified report

Descriptors: (*Speech recognition, Computers), (*Space communication systems, Speech transmission), Band-pass filters, Networks, Circuits, Neurology, Electronic equipment, Voice communication systems, Acoustics, Vocabulary, Automatic, Narrowband, Spectrum analyzers.

A speech-analysis system using analog-threshold logic (ATL) for feature abstraction has been developed to recognize consonants in utterances of CVC words by a number of talkers. The feature-abstraction networks use a single ATL element for most of the logic functions. The ATL element, originally modeled after the biological neuron, has an output which is linearly proportional to the net sum of excitatory and inhibitory inputs, provided that this net sum is greater than some adjustable threshold. Using networks of ATL elements, both the presence and magnitude of significant features can be abstracted in real time from the speech signals. The recognition equipment is capable of abstracting these features over a 60-db dynamic range from the logarithmitized outputs of 19 low-Q, band-pass filters. The speech-recognition equipment contains more than 500 ATL elements and was designed to operate in real time, to utilize parallel processing in the feature-abstraction networks and not to require segmentation. (Author)

AD-604 702 Div. 5, 32
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE ROLE OF MASS COMMUNICATIONS DURING THE BERLIN BLOCKADE,
by W. P. Davison. 22 Apr 55, 14p P-665
Unclassified report

and 1365 cm-1 characteristic of the gem-dimethyl structure. The major feature of the spectra is a very strong band in 1000 cm-1 region assigned as the C-O stretch vibration, which is shifted by the influence of the specific metal atom on the C-O vibration. The butoxides have four characteristic absorptions at about 785 cm-1, 900 cm-1, 1010 cm-1, and 1190 cm-1. The band in the 1000 cm-1 region appears to be the C stretch vibration, the other bands are attributed to skeletal vibrations of the tert-butyl group. The typical C-H deformation of the tert-butyl group is observed at about 1360 cm-1 with a weaker band at 1380 cm-1. In the medium infrared region to 285 cm-1 a small number of very strong absorption bands are found for the tert-butoxides. The results suggest the region would be very satisfactory for characterizing tert-butyl compounds. (Author)

AD-604 733 Div. 4, 14
OTS Prices: HC $2.00/MF $0.50

United States Rubber Co., Wayne, N. J.
PHOSPHONITRILIC POLYMERS STABLE AT HIGH TEMPERATURES.
Quarterly rept. no. 3, 1 May-31 Jul 64,
by Harold K. Garner, Gerald J. Klender, and Aspet Merijanian. 24 Aug 64, 44p
Contract NObs90089, Proj. SR007 03 03, Task 1000
Unclassified report

See also AD-438 187

Descriptors: (*Heat-resistant plastics, Synthesis (Chemistry)), (*Phosphonitrile chrlorides, Polymerization), Quinones, Copolymerization, Amines, Isocyanic acid, Ethers, Electric insulation, Thermosetting plastics, Thermoplastics.

The objective of the investigation is the development of a new thermoplastic and thermosetting resins from phosphonitrilic chloride trimer for high temperature electrical applications. Improved methods for introducing phenoxy blocking groups into the trimer were developed. Additional work was done on the amino derivatives. Copolymerization of phosphonitriles of reduced functionality with hydroquinone was studied, and the introduction of the isocyanate function into the trimer was accomplished. (Author)

AD-604 884 Div. 4, 25
OTS Prices: HC $3.00/MF $0.75

Pennsylvania State Univ., University Park.
THE VIBRATIONAL SPECTRUM, STRUCTURE, AND POTENTIAL CONSTANTS OF NITRIC ACID.
Scientific rept. no. 1,
by I. C. Hisatsune, Gary E. McGraw, and Daniel L. Bernitt. 31 Jul 64, 94p
Contract AF19 604 7987; Grant PHS AP18, Proj. 8603, Task 860303
AFCRL 64 651
Unclassified report

Descriptors: (*Nitric acid, Physical properties), Nitrogen compounds, Oxides, Isotopes, Deuterated compounds, Spectra (Infrared), Raman spectroscopy, Molecular structure, Thermochemistry, Chemical bonds, Ionization potentials.

The work completes a vibrational analysis of four isotopic nitric acid molecules including the N-15 and D-species. The infrared spectra have been obtained in both the vapor and solid states. The Raman spectra of anhydrous and wet HN(14)O3 in the liquid phase were also studied. Three new fundamentals in the solid spectrum have been identified and two vapor phase fundamentals were reassigned. The spectrum of the solid has been interpreted on the basis of a dimeric model. Hot bands of the torsional mode in the vapor phase were resolved, and from them a barrier to hydrogen internal rotation was calculated to be 7.83±0.05 kcal/mole. Force constants were determined which adequately describe the spectra and verify the new assignments. The frequency of the NO2 band is considerably higher than has been observed previously in other molecules containing the NO2 group. Substantial mixing is evident among the normal coordinates identified with the NO symmetric stretch, the NO2 bend, and the HON bend. (Author)

AD-604 906 Div. 4, 7, 25
OTS Prices: HC $2.00/MF $0.50

Coates Chemical Lab., Louisiana State Univ., Baton Rouge.
ON IMPEDANCE MEASUREMENTS: THE DETERMINATION OF THE DOUBLE LAYER CAPACITANCE IN THE PRESENCE OF AN ELECTRODE REACTION; AND CAPILLARY RESPONSE AT A DROPPING MERCURY ELECTRODE.
Technical rept. no. 53,
by R. de Levie. Aug 64, 50p
Contract Nonr1575 04 Proj. NR051 258
Unclassified report

Descriptors: (*Electrical impedance, Measurement), (*Electrodes, Mercury), (*Electrical double layer, Capacitance), Electrolytic cells, Electrochemistry, Capillary tubes, Films, Electrical properties, Electrolytes, Mathematical models.

A solution film inside the capillary is the principal locus of shielding at a DME. A graphical method for obtaining the true double layer capacitance is presented, and a model is given which represents the electrical characteristics of the solution film. A graphical method is given for the determination of both the double layer capacitance and the faradaic impedance from impedance measurements in the presence of a faradaic process. (Author)

AD-605 000 Div. 4, 9
OTS Prices: HC $2.00/MF $0.50

Pennsylvania State Univ., University Park.
CHEMICAL KINETICS AND HYPERSONIC FLOW.
Technical rept.,
by Howard B. Palmer. Aug 64, 34p PSU-11-P
Proj. NR098 038
Unclassified report

Prepared in cooperation with Virginia Univ., Charlottesville, Contract Nonr3623 00

Descriptors: (*Shock tubes, Chemical reactions), (*Hypersonic flow, Reaction kinetics), (*Reaction kinetics, Hypersonic flow), Diatomic molecules, Dissociation, Recombination reactions, Air, Hydrazine, Hydrocarbons, Pyrolysis, Reviews.

Studies in the following areas of shock-tube chemistry are summarized: dissociation of diatomic molecules and recombination of atoms; chemical kinetics of air; thermal decomposition of hydrazine; thermal decomposition of hydrocarbons.

AD-605 115 Div. 4, 15, 26
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A DYNAMIC PROGRAMMING SOLUTION TO A CASCADING PROBLEM ARISING IN HEAVY WATER PRODUCTION,
by Richard Bellman. 14 Nov 56, 8p P-977 Unclassified report

Descriptors: (*Dynamic programming, Chemical engineering), (*Distilling plants, Design), (*Heavy water, Production), Numerical analysis, Sequences, Functions, Optimization, Costs, Cascade structures.

FEDERAL ELECTRIC CORPORATION BIG RALLY II COMMUNICATION SYSTEM TEST PROCEDURES, VOLUME II,
1964, 206p
Contract AF19 628 510
ESD TDR64 451 V2

Unclassified report

See also AD-604 908

Descriptors: (*Command and control systems, Air Force), (*Communication systems, Tests), (*Air Force, Communication systems), Test methods, Test equipment (Electronics), Radio communication sytems, Multiplex, Microwave communication systems, Microwave equipment, Circuits, Attenuation, Networks, Noise (Radio), Generators, Performance (Engineering), Data.

AD-604 910 Div. 5, 8, 18
OTS Prices: HC $6.00/MF $1.25

ITT Federal Electric Corp., Paramus, N. J.
FEDERAL ELECTRIC CORPORATION BIG RALLY II COMMUNICATION SYSTEM TEST PROCEDURES, VOLUME III,
1964, 222p
Contract AF19 628 510
ESD TDR64 451 V3

Unclassified report

Legibility of this document is in part unsatisfactory. Reproduction has been made from best available copy.
See also AD-604 909.

Descriptors: (*Command and control systems, Air Force), (*Communication systems, Tests), (*Air Force, Communication systems), Test methods, Test equipment (Electronics), Radio communication systems, Multiplex, Microwave communication systems, Microwave equipment, Circuits, Networks, Attenuation, Noise (Radio), Radio equipment, Performance (Engineering), Data.

AD-604 911 Div. 5, 8, 18
OTS Prices: HC $7.00/MF $1.75

ITT Federal Electric Corp., Paramus, N. J.
FEDERAL ELECTRIC CORPORATION BIG RALLY II COMMUNICATION SYSTEM. TEST DATA, PHASE I, VOLUME IV.
19 Jun 64, 362p
Contract AF19 628 510
ESD TDR64 451 V4

Unclassified report

See also AD-604 910

Descriptors: (*Command and control systems, Air Force), (*Communication systems, Tests), (*Air Force, Communication systems), Test methods, Test equipment (Electronics), Radio communication systems, Multiplex, Microwave communication systems, Microwave equipment, Radio equipment, Circuits, Networks, Attenuation, Noise (Radio), Performance (Engineering), Generators, Data.

AD-604 912 Div. 5, 8, 18
OTS Prices: HC $7.10/MF $2.00

ITT Federal Electric Corp., Paramus, N. J.
FEDERAL ELECTRIC CORPORATION BIG RALLY II COMMUNICATION SYSTEM. TEST DATA, PHASE II, VOLUME V,
19 Jun 64, 410p
Contract AF19 628 510
ESD TDR64 451 V5

Unclassified report

Legibility of this document is in part unsatisfactory. Reproduction has been made from the best available copy, see also AD-604 911.

Descriptors: (*Command and control systems, Air Force), (*Communication systems, Tests), (*Air Force, Communication systems), Test methods, Test equipment (Electronics), Radio communication systems, Multiplex, Microwave communication systems, Microwave equipment, Radio equipment, Circuits, Networks, Attenuation, Noise (Radio), Performance (Engineering), Data.

AD-604 913 Div. 5, 8, 18
OTS Prices: HC $7.00/MF $1.75

ITT Federal Electric Corp., Paramus, N. J.
FEDERAL ELECTRIC CORPORATION BIG RALLY II COMMUNICATION SYSTEM. TEST DATA, PHASE II, VOLUME VI.
19 Jun 64, 376p
Contract AF19 628 510
ESD TDR64 451 V 6

Unclassified report

Legibility of this document is in part unsatisfactory. Reproduction has been made from best available copy.
See also AD-604 912.

Descriptors: (*Command and control systems, Air Force), (*Communication systems, Tests), (*Air Force, Communication systems), Test methods, Test equipment (Electronics), Radio communication systems, Multiplex, Microwave communication systems, Microwave equipment, Radio equipment, Circuits, Networks, Attenuation, Noise (Radio), Signal-to-noise ratio, Generators, Performance (Engineering), Data.

AD-605 028 Div. 5, 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
OPTIMAL UTILIZATION AND EXTENSION OF INTER-OFFICE TRUNKING FACILITIES,
by R. E. Kalaba and M. L. Juncosa. 15 Nov 56, 22p P-844

Unclassified report

Legibility of this document is unsatisfactory. Reproduction will be made from best available copy.

Descriptors: (*Linear programming, Telephone communication systems), (*Telephone communications systems, Linear programming), Optimization, Equations, Digital computers.

It is shown that a number of interoffice trunking problems involving both usage and extension can be treated in a straightforward and computationally feasible manner by linear programming methods. To test feasibility two simple representative problems for a seven-station unrestricted system are devised. The rapid, successful solution of these problems on one of RAND Corporation's computers, the Johnniac, as well as the extreme flexibility of the models introduced in this paper indicates that as the communications industry turns more and more to large-scale high-speed computers to cope with its large-scale systems problems, linear programming methods will become of increasing importance in carrying out these system-level optimizations.

Descriptors: (*Berlin, Political Science), (*Communication systems, Berlin), (*Air transportation, Berlin), Social communication, History, Newspapers, Radio broadcasting, Public opinion, Population, Communists, USSR, United States, West Germany.

A study of the Berlin blockade and airlift of 1948-49, is presented. The study offered an opportunity to examine the role of mass communications in a crisis situation.

AD-604 801 Div. 5, 12
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE COMMERCIAL USES OF COMMUNICATIONS SATELLITES,
by Leland L. Johnson. Jun 62, 20p P-2601
Unclassified report

Descriptors: (*Communication satellites (Active), Communication systems), (*Global communication systems, (Communication satellites (Active)), Economics, Television communication systems, Education, Bandwidth, Underwater communication systems, Electric cables, Costs, Synchronous satellites Microwave relay systems, Telephone communication systems, Language, Culture.

The purpose of this paper is to appraise briefly the relative merits of communications satellites and conventional techniques, and to provide a more realistic notion of the potential role of communication satellites. Primary emphasis is placed on use in underdeveloped countries.

AD-604 814 Div. 5, 8, 12
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
COMMUNICATIONS IN SPACE OPERATIONS,
by C. M. Crain and R. T. Gabler. 24 Feb 58, 20p
P-1394
Unclassified report

Lecture 15 presented at a course given by RAND Corp. 1958.

Descriptors: (*Space communication systems, Design), (*Radio communication systems, Space communication systems), Voice communication systems, Radio frequency, Space-to-space, Surface-to-space, Noise (Radio), Radio interference, Gain, Attenuation, Doppler effect, Wave transmission, Electric power production, Spacecraft.

The purpose of this paper is to explore the many practical factors involved in earth-space vehicle communication problem, to indicate the factors which will influence most strongly the system designs, and to point out areas in which research and development appear needed.

AD-604 863 Div. 5, 18, 30
OTS Prices: HC $4.00/MF $0.75

International Electric Corp., Paramus, N. J.
STRATEGIC AIR COMMAND CONTROL SYSTEM (465L).
Monthly test progress rept. no. 34, 21 Mar-20 Apr 64,
by W. J. Ernst. 20 May 64, 124p IEC-20130
Contract AF19 626 8
ESD TDR64 415
Unclassified report

Also see AD-602 063

Descriptors: (*Strategic Air Command, Command and control systems), (*Command and control systems, Strategic Air Command), Communication systems, Air Force, Data transmission systems, Data processing systems, Display systems, Test methods, Performance (Engineering), Programming (Computers), Computers, Ground support equipment, Electronic equipment, Reliability (Electronics).

Information is presented concerning each Milestone established in the 465L System Test Plan. The System Test Facility (STF) located at the Contractor's Project Headquarters supported demonstrations, special tests and training. Specific activities reported for the STF included continuation of RFI testing to determine the effectiveness of Circuit Card Suppressors and Signal/Power Line Filters, installation and debug of the D-35 Drawer Tester, and investigation of the RCC Motorola Printer shock problem. Data Display Subsystem activities included continued verification of corrective action being taken to resolve specific equipment problems encountered in Group Display Chain FACI. Activities reported in connection with the Data Processing Subsystem included continuation of the second Disk File retrofit, and reliability testing of the first Disk File. Computer Programming efforts were primarily expended in the preparation of program definition documentation and assessment of program requirements and capabilities to establish a program Baseline. Satisfactory progress with Subsystem Testing of the MCC Part 1 was reported by SDC. Support activities included the continued development of AGE documentation, Evaluation Studies preparations for delivery of the first Color Compatibility Test Report to SPO, and Reliability and RFI testing and data analysis. (Author)

AD-604 908 Div. 5, 8, 18
OTS Prices: HC $4.00/MF $0.75

ITT Federal Electric Corp., Paramus, N. J.
ACCEPTANCE OF BIG RALLY II COMMUNICATIONS SYSTEM.
Final rept.,
Jul 64, 116p
Contract AF19 628 510
ESD TDR64 451 V1
Unclassified report

Descriptors: (*Command and control systems, Air Force), (*Communication systems, Tests), (*Air Force, Communication systems), Test methods, Test equipment (Electronics), Radio communication systems, Multiplex, Microwave communication systems, Microwave equipment, Circuits, Attenuation, Noise (Radio), Networks, Performance (Engineering), Data, Military requirements, Radio equipment.

The Big Rally 2 (BR2) system was designed and built as a temporary communication system to fulfill the immediate needs of the U. S. Air Force. This system is part of a greater network and designed to connect military installations in Italy, Greece and Turkey with command control installations in central Europe. The BR2 interface at site ID was selected as the focal point for system testing. The plan was to take circuits interfaced at ID and running through the system to certain terminal stations, the performance of which would be a yardstick of the system performance. Testing was divided into two basic categories: 1) Individual equipment or station testing and, 2) System testing involving all links assigned to a particular circuit or group of circuits under test. Station testing was effected at all sites and thus tested all items of operational equipment on an individual or single link basis. System tests were planned for circuits or links to present data indicative of the system performance as a whole.

AD-604 909 Div. 5, 8, 18
OTS Prices: HC $6.00/MF $1.25

ITT Federal Electric Corp., Paramus, N. J.

6. Detection

AD-604 367 Div. 6, 8
OTS Prices: HC $1.00/MF $0.50

Carnegie Inst. of Tech., Pittsburgh, Pa. Graduate School of Industrial Administration.
OPTIMAL DETECTION OF AN UNKNOWN DISCRETE WAVEFORM WHICH IS RECURRING IN GAUSSIAN NOISE,
by M. J. Hinich. Jun 64, 22p ONR-RM-123
Contract Nonr760 24
Unclassified report

Descriptors: (*Underwater sound signals, Mathematical prediction), Underwater communication systems, Signal-to-noise ratio, Detection, Noise, Probability, Statistical analysis, Submarines, Sonar signals.

The paper determines the recurrence times of an unknown acoustic signal embedded in additive Gaussian noise.

AD-604 479 Div. 6, 8
OTS Prices: HC $3.00/MF $0.75

Army Electronics Labs., Fort Monmouth, N. J.
ASSEMBLY DESIGN OF MINIATURE LIGHTWEIGHT HANDHELD RADAR SET AN/PPS-6,
by Harry H. French. Sep 63, 85p
Tasks 50 58 05 001 05, 3A99 15 002 03
USAEL TR2421
Unclassified report

Descriptors: (*Radar, Portable), (*Radar equipment, Miniature electronic equipment), Design, Modules (Electronic), Printed circuits, Performance (Engineering), Tests.

This report covers in-house work to provide two modularized, printed wiring models of the (Mark IV) Lightweight Handheld Radar Set (AN/PPS-6). The initial model included packaging design using the latest state-of-the-art techniques for miniaturized, lightweight, ruggedized, electronic modules to meet test and operational requirements initially stipulated by the Radar Division, USAELRDL. The second model was designed to contain additional temperature-compensating circuits to further miniaturize the equipment, and to modify the package design for greater ease of maintenance. (Author)

AD-604 579 Div. 6
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A SEQUENTIAL TEST FOR THE PRESENCE OF A SIGNAL IN ONE OF k POSSIBLE POSITIONS,
by I. S. Reed and Ivan Selin. Apr 62, 17p P-2525
Unclassified report

Descriptors: (*Radar signals, Detection), Sequential analysis, Errors, Probability, Signal-to-noise ratio, Statistical tests.

Consideration is given to a simple sequential test for the presence of a signal known except for one parameter i. This parameter may assume only one of k discrete values, k < infinity. The distribution of the true parameter value is assumed to be uniform over the parameter space. It is shown that the test is almost a maximum likelihood test. Next it is shown how to set the test parameters in order to achieve desired conditional error probabilities, and an approximate expression is obtained for the distribution of the test termination time. (Author)

AD-604 643 Div. 6, 15, 18
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE PROBLEM OF AIMING AND EVASION,
by Rufus Isaacs. 14 Mar 55, 45p P-642
Unclassified report

Descriptors: (*Kill probabilities, Game theory), (*Game theory, Kill probabilities), (*Position finding, Probability), Targets, Mobile, Military strategy.

The general problem of a marksman versus a mobile target, with a time lag in the gunner's information as to the target's position, is mathematically analyzed. Formulated in terms of game theory, the desiderata are: How should the target best maneuver to confound prediction of his position. How and when should the marksman make this prediction. What hit probability is to be expected when both participants behave optimally. The emphasis is on the marksman. He has no optimal strategy, but does have an ideal strategy with the property that every near optimal strategy is close to it. He also has a class of passive epsilon-strategies such that if and only if he obeys their dictates will he either come within epsilon of the best hit probability or else always remain in a position where it is possible to do so. (Author)

AD-604 696 Div. 6, 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
DESCRIPTION OF THE AIR-DEFENSE EXPERIMENTS. III. DATA COLLECTION AND PROCESSING,
by Robert L. Chapman. Rev. 17 Oct 55, 6p P-658
Unclassified report

See also AD-604 687.

Descriptors: (*Collecting methods, Experimental data), (*Data processing systems, Experimental data), (*Learning, Detection), (*Radar interception, Aircraft), (*Air defense systems, Simulation), Recording systems, Telephone lines, Speech, Coding.

AD-604 697 Div. 6, 28
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
DESCRIPTION OF THE AIR-DEFENSE EXPERIMENTS. II. THE TASK ENVIRONMENT,
by Allan Newell. Rev. 17 Oct 55, 5p P-659
Unclassified report

See also AD-604 699

Descriptors: (*Learning, Detection), (*Radar interception, Aircraft), (*Applied psychology, Tests), (*Air defense systems, Simulation), Performance (Human), Air traffic, Simulation, Digital computers, Stress (Psychology).

AD-604 699 Div. 6, 28
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
DESCRIPTION OF THE AIR-DEFENSE EXPERIMENTS. I. THE PHYSICAL AND CULTURAL ENVIRONMENTS,
by William C. Biel. Rev. 17 Oct 55, 7p P-661
Unclassified report

Descriptors: (*Learning, Detection), (*Radar interception, Aircraft), (*Air defense systems, Simulation), Students, Air Force personnel, Performance (Human), Leadership, Air traffic.

AD-605 105 Div. 5, 8, 15, 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
GENERAL SYSTEMS APPROACHES TO TELECOMMUNICATION OPTIMIZATION PROBLEMS,
by R. E. Kalaba and M. L. Juncosa. 1 Mar 57,
22p P-964

Unclassified report

Descriptors: (*Communication systems, Optimization), (*Mathematical programming, Communication systems), (*Optimization, Communication systems), Dynamic programming, Linear programming, Systems engineering, Mathematical models, Networks, Replacement theory, Costs, Equations, Communication theory.

Linear programming and dynamic programming techniques are used to treat large scale communication system optimization problems at the system level in a straightforward and computationally feasible manner. Treatments for communication system extension problems and for equipment replacement policies are provided. Various generalizations are indicated.

7. Electrical Equipment

AD-604 434 Div. 7, 8, 26
OTS Prices: HC $1.00/MF $0.50

Mallory (P. R.) and Co., Inc. Indianapolis, Ind.
PRODUCTION ENGINEERING MEASURE FOR IMPROVED RELIABILITY OF SOLID ELECTROLYTE TANTALUM CAPACITORS.
Quarterly rept. no. 4, 30 Mar-29 Jun 64,
by A. W. H. Smith. 29 Jun 64, 20p
Contract DA36 039AMC03623E

Unclassified report

Descriptors: (*Tantalum capacitors, Manufacturing methods), (*Electrolytic capacitors, Reliability (Electronics)), Anodes, Binders, Lubricants, Material forming, Impregnation, Graphite, Silver, Paints, Temperature, Aging (Materials), Voltage, Welding, Soldering, Failure (Mechanics), Life expectancy, Tantalum, Powders, Manganese compounds, Dioxides, Coatings, Wire.

The remaining materials evaluation tasks have been completed this quarter. Work on Anode Pressing, Anodization and Reformation is finished except for Specification Review. Presintering studies have uncovered some possible deficiencies in the binder/lubricant selected for study. Improvements in furnace design and control have been made. Work on Specifications continues and the major portion of the work is expected to be done by the end of next quarter. The Assembly tasks have been started and some new equipment obtained. It is anticipated that the sintering and presintering phases of the program will be completed by the end of next quarter. (Author)

AD-604 496 Div. 7, 26
OTS Prices: HC $2.00/MF $0.50

Weston Instruments, Inc., Newark, N. J.
PRODUCTION ENGINEERING MEASURE FOR RUGGEDIZED TAUT BAND SUSPENSION PANEL METERS.
Final rept. for 1 Apr 61-30 Jun 64.
30 Jun 64, 40p
Contract DA36 039SC85952

Unclassified report

Descriptors: (*Panel boards (Electricity), Measuring devices (Electrical and electronic), (*Measuring devices (Electrical and electronic), Panel boards (Electricity), Ammeters, Design, Production, Sensitivity, Performance (Engineering), Test methods, Photographs, Construction, Military requirements, Measurement.

This report establishes the facilities and competence to produce ruggedized taut band suspension panel meters in accordance with Signal Corps Technical Requirements SCS-43A. These meters have electrical and general performance characteristics currently unobtainable with conventional pivoted military types of indicating meters.

AD-604 574 Div. 7, 12
OTS Prices: HC $6.00/MF $1.50

Thompson Ramo Wooldridge, Inc., Cleveland, Ohio.
HIGH TEMPERATURE SOLAR THERMIONIC GENERATORS.
Rept. for 15 Apr 63-31 Aug 64.
31 Aug 64, 275p TRW-ER-6044
Contract AF33 657 11169, Proj. 8173, Task 817305 24
APL TDR64 92

Unclassified report

Descriptors: (*Thermionic converters, Solar radiation), (*Solar radiation, Energy conversion), Spacecraft, Electric power production, Design, Performance (Engineering), Tests, Cesium, Vapors, Electron bombardment, Shielding, Filaments, Tantalum, Beryllium compounds, Magnesium compounds, Oxides.

The results of solar evaluations of a 100 watt thermionic generator conducted under a solar flux range of 80 to 100 watts/sq. ft. are presented. Generator performance optimization, misorientation, cyclic and transient response tests were accomplished. Good correlation of the generator's solar performance with laboratory performance was obtained and indicated that at the 130 watts/sq. ft. solar flux level of outer space, the generator would be capable of achieving the full design power output of 100 watts. In addition, results of cyclic and continuous life test of 'practical hardware' thermionic converters are given for three design iterations. Discussion of design details, and life limiting characteristics of each design, through a two year development period illustrate the progress made in extending the 'continuous' life operation to over 3600 hours and 'cyclic' life operation beyond 2900 deep thermal cycles. The preliminary design of a solar thermionic generator was also completed. Because of the unexpected long life (approximately 3000 hours of continuous operation) demonstrated by the converter, an alternate generator design, utilizing thermal energy storage was completed. (Author)

AD-604 653 Div. 7, 15
OTS Prices: HC $1.00/MF $0.50

Coordinated Science Lab., Univ. of Illinois, Urbana.
GENERATIONS OF TREES WITHOUT DUPLICATIONS,
by W. Mayed and S. Seshu. Jul 64, 18p CSL-R-220
Contracts DA28 043AMC00073E, AF49 638 1383

Unclassified report

Descriptors: (*Electrical networks, Topology), (*Topology, Electrical networks), Graphics, Transformations (Mathematics), Set theory, Equations.

The purpose of this note is to describe a procedure for generating all trees of a linear graph without duplication. The trees are generated in a systematic fashion by elementary tree transformations (replacement of one branch), and hence the sign computation is performed simply. Since the procedure guarantees that there is no duplication, networks in which the number of trees exceeds the fast memory available in a computer, can be handled. The procedure requires that one generate a starting tree, which is easy to do on a machine, and that one compute the fundamental cut-sets for a given tree, which is again easy to do. (Author)

AD-604 736 Div. 7, 26
OTS Prices: HC $1.00/MF $0.50

Du Pont de Nemours (E. I.) and Co., Inc.,
Wilmington, Del.
HIGH TEMPERATURE THERMOELECTRIC GENERATOR.
Quarterly rept. for period ending 31 Mar 64,
by W. T. Hicks. 31 Mar 64, 9p
Contract NObs88639

Unclassified report

See also AD-430 443.

Descriptors: (*Thermoelectricity, Generators), (*Generators, Thermoelectricity), Modules (Electronic), Power equipment, Heat exchanger, Materials, Seals (Stoppers), Copper, Sodium, Lead alloys, Intermetallic compounds, Tellurium alloys, Tantalum, Tungsten

AD-604 952 Div. 6, 8, 22
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
MAXIMUM ANGULAR ACCURACY OF A PULSED SEARCH RADAR,
by P. Swerling. Rev. 10 Apr 56, 40p P-745
Unclassified report

Descriptors: (*Search radar, Target angle), Position finding, Errors, Radar pulses, Radar receivers, Noise (Radar), Signal-to-noise ratio, Target recognition, Correlation techniques, Detection.

An investigation is made of the limits imposed by receiver noise on the accuracy with which the angular position of a target can be determined by a pulsed search radar. Using a result in the theory of statistical estimation, a lower bound is derived for the standard deviation of regular unbiased estimates of target angular position, for a large class of methods of angular position determination; the lower bound depends on scan rate, pulse repetition rate, beamwidth, beam shape, and signal-to-noise ratio. A similar analysis is made of the limits on angular accuracy imposed by a combination of receiver noise and one particular type of target cross section fluctuation. Operations which can be performed on the received signal to form an estimate of target angular position, the standard deviation of which approximately attains the theoretical lower bound, are discussed. The relation between the estimation of angular position and the problem of target detection is discussed. A graphical presentation of the main results is given. (Author)

Descriptors: (*Thermoelectricity, Materials), (*Power supplies, Thermoelectricity), Thermocouples, Manufacturing methods, Magnesium alloys, Antimony alloys, Bismuth alloys, Energy conversion, Diffusion, Thermal conductivity, Resistance (Electrical), Packaging.

This report summarizes the development effort in two sections. Section I describes the progress which has yielded significant hardware in the area of the cartridge couple. Section II describes the progress in the development of advanced thermoelectric materials.

alloys, Impurities, Selenium alloys, Gold alloys, Soldering, Nickel alloys, Encapsulation, Aluminum compounds, Silicates, Pipes, Synthetic rubber, Bonding, Air cooled, Semiconductor devices, Tests, Performance (Engineering).

The construction of the modules for the 300-watt generator has been standardized, except for the air seal on the cold end of the modules. The segmented positive leg of the modules consists of a copper heat sink followed by a sodium-doped lead telluride cylinder and terminated by a tantalum-doped tungsten diselenide cylinder. The negative leg of the modules consists of a gold-nickel alloy strap, running (insulated) along one side and joined to the hot end of the positive leg. Satisfactory soldering and brazing methods for joining these elements have been developed. The assembly is encapsulated in a closed-end mullite tube. (Author)

AD-604 889 Div. 7, 25
OTS Prices: HC $2.00/MF $0.50

Allison Div., General Motors Corp., Indianapolis, Ind.
MEASUREMENT OF FLUID PROPERTIES FOR MAGNETOPLASADYNAMIC POWER GENERATORS.
Quarterly technical summary rept. no. 5, 1 May-31 Jul 64, by R. T. Schneider. 17 Aug 64, 48p EDR-3965
Contract Nonr4104 00, ARPA Order420

Unclassified report

Descriptors: (*Magnetohydrodynamics, Generators), (*Energy conversion, Magnetohydrodynamics), Electric power production, Plasma medium, Cesium, Injection, Pumps, Helium, Separation, Magnetic fields, Voltage, Electrodes.

It was found that at low field strengths the generator voltage is proportional to the magnetic field strength. With increasing field strength the voltage deviates from this proportionality and finally saturates. A possible explanation of this phenomena is presented. The definition of one of the generator operational problems will allow a logical attack on the imposed limitations. The closed loop research facility has undergone several modifications to improve the operational and control characteristics. The design of the generator for Phase II of the contract was initiated. (Author)

AD-604 904 Div. 7, 17, 25, 26
OTS Prices: HC $1.00/MF $0.50

Du Pont de Nemours (E. I.) and Co., Inc., Wilmington, Del.
HIGH TEMPERATURE THERMOELECTRIC GENERATOR.
Quarterly rept. for 1 Oct-31 Dec 63, by W. T. Hicks and H. Valdsaar. 31 Dec 63, 12p
Contract NObs88639

Unclassified report

Descriptors: (*Thermoelectricity, Generators), (*Generators, Thermoelectricity), (*Gold alloys, Thermoelectricity), Modules (Electronic), Nickel alloys, Encapsulation, Intermetallic compounds, Tungsten alloys, Selenium alloys, Lead alloys, Tellurium alloys, Tantalum, Impurties, Oxidation, Semiconductors, Joining, Performance (Engineering), Design, Nickel alloys, Copper alloys.

A new, thermoelectric alloy with a negative Seebeck coefficient has been investigated, Au-9 w/o Ni. The physical and chemical properties of this alloy are superior to those of constantan used in earlier work as the negative leg and encapsulant for segmented p-type legs of Ta-doped WSe2 and PbTe. The gold alloy has a higher Seeback coefficient than constantan, does not react with Se vapors, and is oxidation resistant. Design of thermoelectric modules has been altered to make use of the new alloy. No change is required in design of the generator. Preparation and processing of WSe2 has been standarized. Some earlier results on modules using constantan are summarized. (Author)

AD-604 905 Div. 7, 14, 25, 26
OTS Prices: HC $1.00/MF $0.50

Du Pont de Nemours (E. I.) and Co., Inc., Wilmington, Del.
HIGH TEMPERATURE THERMOELECTRIC GENERATOR.
Quarterly rept. for period ending 30 Jun 64, by W. T. Hicks. 30 Jun 64, 10p
Contract NObs88639

Unclassified report

Descriptors: (*Thermoelectricity, Generators), (*Generators, Thermoelectricity), Modules (Electronic), Semiconductors, Tungsten alloys, Selenium alloys, Tantalum, Impurities, Lead alloys, Sodium, Tellurium alloys, Bonding, Indium alloys, Gold alloys, Plating, Copper, Soldering, Stainless steel, Performance (Engineering), Degradation, Air, Oxidation, Gas seals, Synthetic rubber, Pipes, Adhesives, Silicone plastics, Degasification.

Degradation of module performance due to air oxidation of semiconducting elements has now been overcome by development of an appropriate sealing technique and use of 02 getters within the module. Some compression of the modules will be required to assure adequate heat flow at the hot junction. Design of the 300 watt prototype generator is complete and fabrication is in progress. All materials required are on hand. (Author)

AD-604 984 Div. 7, 25
OTS Prices: HC $1.00/MF $0.50

Stanford Research Inst., Menlo Park, Calif.
THERMOELECTRIC MATERIALS.
Final rept. for 8 Apr 63-8 Jun 64, by J. W. Johnson. 8 Jun 64, 18p
Contract NObs88487, Proj. S R007 12 01, PAU4444

Unclassified report

Descriptors: (*Thermoelectricity, Materials), (*Semiconductors, Thermoelectricity), Resistance (Electrical), Liquids, Inorganic compounds, Bismuth compounds, Sulfides, Copper compounds, Phosphides, Lead compounds, Phase studies, Eutectics, Temperature, Energy conversion.

The primary objectives of this research were to lower the operating temperature of p-type systems based on liquid cuprous sulfide and to explore the possibility of producing an n-type liquid semiconductor material. Toward these ends the work herein reported was confined to a study of the resistivity and Seebeck coefficient of liquid inorganic sulfide systems.

AD-604 997 Div. 7, 17, 25, 26
OTS Prices: HC $3.00/MF $0.75

General Electric Co., West Lynn, Mass.
RESEARCH AND DEVELOPMENT OF MATERIALS AND FABRICATION TECHNIQUES FOR THERMOELECTRIC POWER GENERATION.
Final rept. for 1 Jan 62-1 Apr 63. 10 Dec 63, 64p
Contract NObs86854, Proj. SR007 12 01, Task 802

Unclassified report

Numerical analysis, Partial differential equations, Motion, Automatic, Analysis, USSR, Magnetic tape, Motion picture film, Paper, Tapes.

The effect of nonuniform motion of the carrier on the performance of the correlator during the recording and reproduction of investigated signals is discussed. It is shown that periodic carrier rate fluctuations lead to linear distortions of correlator output signal.

AD-604 346 Div. 8
OTS Prices: HC $2.00/MF $0.50

SFD Labs., Inc., Union, N. J.
PRODUCTION ENGINEERING MEASURE FOR A Ka-BAND INVERTED COAXIAL MAGNETRON.
Quarterly progress rept. no. 4, 7 Feb-6 May 64,
by P. du Fosse and G. Glenfield. May 64, 34p
SFD-29-QPR-4a
Contract DA36 039AMC01472E

Unclassified report

Descriptors: (*Magnetrons, K band), Life expectancy, Anodes (Electron tubes), Test equipment, Broadband, Resonators, Performance (Engineering), Manufacturing methods.

Thirteen model tubes were built and evaluated, the results of which are presented. Initial life test results are reported as are the results of the completed heater cycle life tests. The results of the anode evaluation program, which yielded high Q sub u, broad band, low voltage anodes, are discussed. Tubes which meet the primary electrical specifications and were delivered as the fifth and sixth engineering samples are described. (Author)

AD-604 357 Div. 8, 26
OTS Prices: HC $2.00/MF $0.50

Instrumentation Lab., Mass. Inst. of Tech., Cambridge.
MAXIMUM DENSITY PACKAGING OF ANALOG ELECTRONICS,
by Richard M. Jansson. Oct 58, 36p E-765
Contract AF04 645 9, Proj. 52126

Unclassified report

Descriptors: (*Packaged circuits, Analog systems), (*Subminiature electronic equipment, Packaged circuits), Manufacturing methods, Spot welding, Encapsulation, Epoxy plastics, Modules (Electronic), Inertial guidance, Costs.

Electronic packaging techniques which can be applied to subminiature electronic devices and complex systems are developed. These techniques are based on the mounting and wiring of circuit components in a three-dimensional unit mass. Using the most suitable electronic circuit components now available, the Instrumentation Laboratory has achieved maximum component densities. These densities are obtained without sacrificing production feasibility. The Laboratory's packaging techniques are immediately available for use and have design flexibilities great enough to handle a variety of circuitry. (Author)

AD-604 372 Div. 8, 2, 25
OTS Prices: HC $1.00/MF $0.50

Kiruna Geophysical Observatory (Sweden).
POLARIZATION CHARACTERISTICS OF AURORAL ECHOES AT 88.5 Mc/s.
Scientific rept. no. 5,
by Alv Egeland. 10 Oct 61, 22p
Contract AF61 052 418
AFCRL 62 114

Unclassified report

Descriptors: (*Aurorae, Electromagnetic wave reflections), (*Radio waves, Electromagnetic wave reflections), (*Polarization, Radio waves), Propagation, Very high frequency, Measurement, Radio equipment, Physics laboratories, Sweden.

The purpose of this investigation was to study the polarization characteristics of aurorally reflected radio waves at 88.5 Mc/s. Horizontally polarized waves were transmitted and the aurorally reflected waves were received simultaneously on two orthogonally polarized antennas. The most important characteristics of this investigation are summarized as follows: (1) During all strong period of auroral activity the reflected signals were found to be strongly depolarized, but the amplitude of the vertically-polarized echo never exceeded that of the horizontal component. (2) The polarization of the reflected waves was often rather irregular with polarization components tilted in different directions. (3) Great and sudden changes in the depolarization effects were often observed. Possible explanations of the change in the state of polarization of a radio wave reflected by auro[illegible] ionization are discussed. (Author)

AD-604 410 Div. 8, 26
OTS Prices: HC $3.00/MF $0.50

Linde Div., Union Carbide Corp., Parma, Ohio.
DEVELOPMENT OF THIN ORGANIC ROLLED FILM CAPACITOR.
Quarterly progress rept. no. 4, 1 Apr-30 Jun 64.
30 Jun 64, 52p
Contract NObsr89519, Proj. SR0080302ST9636

Unclassified report

Descriptors: (*Capacitors, Production), (*Dielectrics, Films), Aluminum, Foils, Cleaning, Electrolytic polishing, Material forming, Construction, Organic materials, Plastic coatings, Stability, Reliability (Electronics).

Progress is reported on a program to develop a capacitor, using ML-1 film as the dielectric, capable of 100 volt operation over the temperature range of -55 to 170C (See AD-600 317). Topics include: foils (substrate preparation, surface decontamination, mechanical smoothing, electropolishing); coated foil evaluation; new slitting machine; metallized type ML-1 film capacitor materials and constructions; standard process; process improvements (reduced heat input, can atmosphere, dust free conditions); stability and reliability testing.

AD-604 412 Div. 8
OTS Prices: HC $4.00/MF $0.75

Electro-Mechanics Co., Austin, Tex.
TECHNIQUES OF MULTIMODAL ANALYSIS IN WAVEGUIDES EMPLOYING A SEMI-INFINITE SLAB OF MERCURY.
Final rept.
Jul 64, 105p
Contract AF30 602 2902, Proj. 4540, Task 454001
RADC TDR64 248

Unclassified report

The major portion of the rept. is submitted as a Thesis of Lars N. Engel for the degree of M. S. in Electrical Engineering at the Univ. of Texas.

8. Electronics and Electronic Equipment

AD-604 333 Div. 8
OTS Prices: HC $2.00/MF $0.50

Eitel-McCullough, Inc., San Carlos, Calif.
HIGH POWER X-BAND GENERATOR.
Quarterly rept. no. 6, 1 Jan-31 Mar 64,
by William R. Luebke, Jared Leidigh, and Tore Wessel-Berg. 21 May 64, 41p
Contract AF30 602 2756
RADC TDR64 257

Unclassified report

Descriptors: (*Microwave amplifiers, X-band), (*Klystrons, X-band), Waveguide windows, Cavity resonators, Performance (Engineering), Pulse generators, Radiofrequency generators, Electron beams, Excitation, Mathematical analysis, Functional analysis, Power, Waveguide couplers, Circuits, Design.

The purpose of this program is to develop a klystron amplifier operating at 8 kMc and delivering one megawatt of CW power. Two long-pulse interim tubes were tested but neither achieved significant average power levels. The development of output windows for these high-average power tubes is discussed. Test results on a short pulse tube having a two-gap penultimate cavity are summarized. Further development work on extended-interaction buncher cavities is described. A theoretical analysis of some large-signal aspects of the excitation of an extended-interaction cavity by an electron beam is included. (Author)

AD-604 334 Div. 8
OTS Prices: HC $2.00/MF $0.50

Rome Air Development Center, Griffiss AFB, N. Y.
TEST AND EVALUATION REPORT ON LOG-PERIODIC ANTENNA GROUP AN/TSA-17( ).
Test and Evaluation rept.,
by Adolph J. Uryniak. Jun 64, 30p
RADC TDR64 178

Unclassified report

Descriptors: (*Log periodic antennas, Portable), Dipole antennas, High frequency, Medium frequency, Antenna configurations, Antenna components, Performance (Engineering), Antenna radiation patterns, Gain, Electrical impedance, Standing wave ratios, Storage.

A 2.5 kw Peak Envelope Power (PEP) non-rotatable restricted height, lightweight, transportable, quickly erectable antenna in the 2-30 mc region using the log periodic principle, has been developed for TAC application. The antenna, nomenclatured AN/TSA-17, can be erected in less than two hours by 5 men. The disassembled antenna array is packaged in three carrying cases and the dismantled supporting towers are nested in three bottom 10-foot sections. Total antenna weight is 850 pounds. Test results indicate the AN/TSA-17 suitable for TAC use and wherever a lightweight transportable antenna is required. (Author)

AD-604 335 Div. 8, 20
OTS Prices: HC $4.00/MF $0.75

McDonnell Aircraft Corp., St. Louis, Mo.
NUCLEAR EFFECTS PREDICTION TECHNIQUES FOR TELEMETRY.
Final rept.,
by T. J. Klingen, S. K. Misra, B. J. Stralser, and D. J. Welling. May 64, 116p MAC-A810
Contract AF33 657 11533, Proj. 4107, Task 410721
AL TDR64 112

Unclassified report

Descriptors: (*Semiconductor devices, Radiation damage), (*Telemeter systems, Radiation damage), (*Radiation damage, Telemeter systems), Reviews, Circuits, Mathematical models, Mathematical prediction, Resistors, Transistors, Gain, Transients, Photoelectric effect, Compton scattering, Nuclear weapons, Nuclear reactors, Space environmental conditions.

A literature survey was performed to study various nuclear effects prediction techniques. Circuit equations and a mathematical model were developed which are used to predict the response of a simple circuit during and after irradiation when exposed to nuclear radiation. If desired, a digital computer may be used as an aid in solutions. The approach uses circuital analysis rather than component analysis. An experimental program is outlined which is intended to verify the prediction techniques involved. (Author)

AD-604 336 Div. 8
OTS Prices: HC $0.75/MF $0.50

Naval Research Lab., Washington, D. C.
THE ANALYSIS OF VARIABLE RELUCTANCE TRANSDUCERS: THE ENERGY METHOD.
Interim rept.,
by Robert M. Moore. 20 Jul 64, 24p
Proj. RF001 03 44 4052
NRL 6089

Unclassified report

This rept. is companion to NRL Rept. 6088, Mar 64, 'The Analysis of Variable Reluctance Transducers: The Classical Method.'

Descriptors: (*Transducers, Mathematical analysis), Electromagnetic properties, Magnetic fields, Functions, Taylor's series, Electrical networks, Energy, Energy conversion, Equations.

The operating equations of a variable reluctance transducer are derived in this report through the application of the conservation of energy principle. These equations are formulated in terms of the energy stored in the magnetic field. The basic equations are shown to be nonlinear, and a set of approximate linear equations is derived for a special class of inputs. The method is applied to a double field, double mass transducer as an illustrative example. This report and NRL Report 6088 are companion reports dealing with the derivation of the equations of variable reluctance transducers. (Author)

AD-604 342 Div. 8
OTS Prices: HC $1.00/MF $0.50

Foreign Tech. Div., Air Force Systems Command, Wright-Patterson AFB, Ohio.
AUTOMATIC COMPUTATION OF CORRELATION FUNCTIONS IN THE CASE OF NONUNIFORM TRAVEL OF SIGNAL-CARRYING TAPE,
by G. O. Ball. Aug 64, 20p
FTD TT64 294; TT 64 71237

Unclassified report

Unedited rough draft trans. of Avtomatyka (USSR) 1963 [v. 8] no. 3, p. 47-58.

Descriptors: (*Correlators, Errors), (*Recording systems, Distortion), Signals, Linear systems,

Electronic Manufacturers Association). The technical program had 42 diversified subject sessions, which included a total of almost 120 papers in the field. (Author)

AD-604 480 Div. 8, 15
OTS Prices: HC $2.00/MF $0.50

Lincoln Lab., Mass. Inst. of Tech., Lexington.
A METHOD FOR EVALUATING A GENERALIZED FRESNEL INTEGRAL RELATED TO THE SPECTRA OF AMPLITUDE AND FREQUENCY MODULATED PULSES.
Group rept.,
by E. B. Temple. 5 Aug 64, 30p LL-1964-43
Contract AF19 628 500, ARPA Order 498
ESD TDR64-360

Unclassified report

Rept. on Proj. DEFENDER.

Descriptors: (*Radar pulses, Integrals), (*Integrals, Radar interference), Electromagnetic pulses, Frequency modulation, Amplitude modulation, Geometric forms, Linear systems, Mathematical analysis.

Asymptotic expressions for the Fourier spectra of pulses modulated by a carrier frequency plus linear FM are obtained for several pulse shapes, using an asymptotic series for the complex Fresuel integral. A geometric interpretation of the terms in this series is given. (Author)

AD-604 492 Div. 8, 26
OTS Prices: HC $8.10/MF $2.25

Western Electric Co., Laureldale, Pa.
PRODUCTION ENGINEERING MEASURES. HIGH FREQUENCY TRANSISTOR.
Final rept. for 20 Jun 61-20 Jun 64,
by T. G. Stoudt. 20 Jun 64, 506p
Contract DA36 039SC85969

Unclassified report

Descriptors: (*Transistors, Production), High frequency, Microwave equipment, Germanium, Manufacturing methods, Tests, Test equipment, Design, Experimental data, Gain, Amplifiers, Oscillation, Feedback, Crystal growth, Evaporation, Measurement, Quality control.

The final report presents a review of the project and significant work accomplished during engineering development in fabricating the GF-40036, a high frequency transistor.

AD-604 501 Div. 8
OTS Prices: HC $1.00/MF $0.50

Instrumentation Lab., Mass. Inst. of Tech., Cambridge.
MINIATURE PACKAGING OF ELECTRONICS IN THREE-DIMENSIONAL FORM,
by Eldon C. Hall and Richard M. Jansson.
Jun 59, 20p E-823
Contracts AF04 647 303, NOrd17366,
Projs. 52 156, 52 138

Unclassified report

Descriptors: (*Miniature electronic equipment, Packaging), (*Packaging, Miniature electronic equipment), Digital computers, Analog systems, Circuits, Design, Manufacturing methods, Aerospace craft.

By using miniature components now available from manufacturers and a newly applied method of joining wire leads, an electronic-packaging technique based on the mounting and wiring of circuit components in a miniature three-dimensional unit mass was developed. This new technique, referred to as 3-D or High-Density Electronic Packaging, has achieved a maximum component density without sacrificing production feasibility. It consists of placing circuit elements in physical contact (side by side) and forming the circuit connections on a three-dimensional basis, as opposed to the two-dimensional printed-circuit board. The wires are joined by electrical-resistance spot welding, which is similar to the vacuum-tube technique. After assembly and electrical checkout, the unit is encapsulated in epoxy potting compounds to form a module. The resulting miniature package is a maximum-density assembly utilizing all practical space within the package.

AD-604 502 Div. 8
OTS Prices: HC $1.00/MF $0.50

Instrumentation Lab., Mass. Inst. of Tech., Cambridge.
HIGH-SPEED REVERSIBLE RING COUNTER,
by Ken Hagen. Apr 61, 18p E-1015
Contract AF04 647 303, Proj. 52 156

Unclassified report

Descriptors: (*Pulse counters, Circuits), Transistors, Coupling circuits, Capacitors, Propagation.

A low power reversible ring counter capable of counting rates up to 750 kcps is presented. The counter utilizes transistors and operates at low power levels; it may easily be miniaturized. (Author)

AD-604 505 Div. 8
OTS Prices: HC $5.00/MF $1.00

Microwave Lab., Stanford Univ., Calif.
EXTENDED INTERACTION KLYSTRONS WITH TRAVELING-WAVE CAVITIES.
Technical rept.,
by Hellmut Golde. Apr 59, 162p ML-582
Contract N6onr251 23, Proj. NR373 361

Unclassified report

Descriptors: (*Klystrons, Cavity resonators), (*Cavity resonators, Klystrons), Gain, Bandwidth, Electron beams, Transmission lines, Microwaves, Resonators, Coupling circuits, Oscillation, Electrical impedance, Velocity, Space charges, Propagation, Design, Theory, Equations.

Klystrons with extended interaction regions can have a larger gain-bandwidth product and higher efficiencies than conventional klystrons. This study pertains to a new type of extended interaction cavity, consisting of a closed transmission line loop which will support a traveling wave if the loop is properly excited. Two methods of excitation, both using a directional coupler, are described. An electron beam can interact with this traveling wave over part of the closed loop. A general theory of the traveling-wave resonator in the absence of an electron beam is given. The important parameters for interaction with an electron beam are derived. Measurements on an experimental cavity agree very well with theory.

AD-604 506 Div. 8, 25
OTS Prices: HC $3.00/MF $0.75

Stanford Electronics Labs., Stanford Univ., Calif.
ELECTRON DEVICES RESEARCH.
Consolidated quarterly status rept. no. 8, 1 Oct-31 Dec 58.
31 Dec 58, 91p
Contracts DA36 039sc73178, AF33 600 27784,
Projs. NR373 360, NR373 370

Unclassified report

Descriptors: (*Waveguides, Test methods), Mercury, Probes (Electromagnetic), Electric fields, Intensity, Standing wave ratios, Harmonic analysis, Measuring devices (Electrical and Electronic).

The study consists of an examination of a unique technique for measuring the modes within a waveguide. The technique provides for electric field intensity measurements in a waveguide by using a pool of mercury as one side of a waveguide section. A movable probe needle which projects above the mercury pool, measures the fields within the waveguide. The research includes the calculation of parameters governing voltage breakdown due to the presence of mercury vapor; the comparison of voltage standing wave ratio measurements obtained from a slotted waveguide with the measurements obtained from the mercury waveguide; transverse electric field measurements obtained by moving the probe across the broad wall of the mercury waveguide at the fundamental, second, and third harmonics; the development of a multimode launcher; and the development of a multimode load. (Author)

AD-604 413 Div. 8,
OTS Prices: HC $2.00/MF $0.50

National Co., Inc., Malden, Mass.
PRODUCTION ENGINEERING MEASURE FOR CESIUM BEAM TUBES.
Quarterly progress rept. no. 2, 23 Aug-23 Nov 63,
by James George. 23 Nov 63, 40p
Contract DA36 039AMC01457

Unclassified report

Descriptors: (*Cesium electron tubes, Manufacturing methods), Performance (Engineering), Design, Failure (Mechanics), Signal-to-noise ratio, Quality control, Experimental data, Frequency shift, Electron tube heaters, Signals, Intensity.

The tasks performed during this reporting period involved the fabrication, assembly, and test of the first two (PEM-E1 and PEM-E2) of six engineering model cesium beam tubes. Performance characteristics and test data are presented. In addition, the design changes to be incorporated in the third (PEM-E3) and fourth (PEM-E4) cesium beam tubes are discussed. (Author)

AD-604 419 Div. 8, 16, 25
OTS Prices: HC $3.00/MF $0.75

Ohio State Univ., Columbus. Research Foundation.
INVESTIGATION OF NEW SEMICONDUCTOR PHENOMENON.
Rept. for Jul 61-Feb 63,
by K. K. Knaell and M. O. Thurston. Jun 64, 75p
Contract AF33 616 8384, Projs. 7222, 1287,
Task 722203
AMRL TDR63 117

Unclassified report

Descriptors: (*Transistors, Gain), (*Semiconductor devices, Silicon), Semiconductors, Circuits, Diodes (Semiconductor), Electrical impedance, Voltage, Electrical properties, Measurement, Electric currents, Transistor amplifiers, Surface properties, Moisture, Absorption (Physical), Pulse generators, Medical equipment, Biophysics.

Certain silicon-grown junction transistors were discovered which manifested unusually high short circuit current gains, h sub fe. The present investigation was made to determine the basic nature of this h sub fe and to develop an h sub fe transistor. Following several unsuccessful attempts at producing devices designed to display h sub fe, further measurements were made on already existing transistors. These measurements led to several observations unexplainable in the light of the original model; therefore, additional measurements were performed. These measurements gave more insight into the transistor and explained some of the characteristics of its behavior in terms of its high h sub fe. Attention was then concentrated on the physical structure of the transistor and experiments were performed to alter the structure in an attempt to learn the mechanism causing high h sub fe. Adsorbed moisture had a tremendously beneficial effect on the dynamic current gain of the device and the high h sub fe was a surface effect caused by this adsorbed moisture. Finally, a high-gain transistor was produced from a normal unit making use of this information. The amount of high gain of this transistor was variable within limits and the behavior appeared similar to that of the unusual units originally discovered. (Author)

AD-604 422 Div. 8, 15
OTS Prices: HC $2.00/MF $0.50

Stanford Research Inst., Menlo Park, Calif.
COUPLED-MODE THEORY FOR ADVANCED MICROWAVE DEVICES.
Final rept. for Mar-62-Mar 64,
by M. C. Pease. Aug 64, 40p
Contract AF33 657 8343, Proj. 4156, Task 415604
AL TDR64 177

Unclassified report

Descriptors: (*Microwave equipment, Electron beams), (*Electron beams, Theory), Traveling wave tubes, Lasers, Parametric amplifiers, Noise (Radio), Algebras, Electric fields, Integration, Coupling circuits, Propagation, Magnetic fields, Theorems, Transmission lines, Electron tubes.

This report summarizes results obtained for (a) pairwise coupling in uniform systems, (b) multimode coupling in uniform systems, and (c) nonuniform systems. The work on pairwise coupling in uniform systems is intended to pull together the existing body of theory of such systems, and to systematize this theory. In multimode coupling, it is recognized that the principal problem is the categorization of the various possible situations. A basis for doing this has been found in the theory of Lie algebras. It is possible to use this theory to diagram the couplings involved. Several interesting results are obtained in the development of a statistical coupled mode theory. Among nonuniform systems, the class for which the derivative of the system operator is expressible as the commutator of the system operator with another operator is studied. A number of important results are obtained.

AD-604 452 Div. 8
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
WESTERN ELECTRONIC SHOW AND CONVENTION (WESCON), SAN FRANCISCO, CALIFORNIA, 1961,
by Marian M. Hatch. Feb 62, 41p P-2522

Unclassified report

Descriptors: (*Reports, Electronics), (*Radio astronomy, Reports), Electronic equipment, Industries, Space probes, Space flight, Manned, Aerospace craft, Arms control, National defense, Cold war, Geophysics, Planets, Lasers, Solenoids, Space communication systems.

The more than 35,000 engineers attending the Western Electronic Show and Convention found special emphasis in the field of radio astronomy. WESCON was held August 22-25, 1961, under the joint sponsorship of the 7th Region of the IRE (Institute of Radio Engineers) and WEMA (Western

purpose of reducing cross modulation, intermodulation and overload. During this quarter improvement of the noise level of the tubes without destroying the good level of interference suppression was attempted. Tests were made to find a simple automatic gain control system which could be incorporated in the design. The dimensions of construction D in so far as the dimensions have influence on the transfer characteristics are defined. Tests were performed on the R390A receiver to establish the receiver characteristics for a comparative evaluation.

AD-604 644 Div. 8, 5
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
RADIATION PATTERNS OF UNSYMMETRICALLY FED PROLATE SPHEROIDAL ANTENNAS,
by H. A. Myers. Rev. 18 Aug 55, 19p P-645
Unclassified report

Extracted from a Ph.D. thesis submitted at Michigan State College.

Descriptors: (*Antenna radiation patterns, Analysis), Antennas, Spheres, Partial differential equations, Power series, Series, Functions, Electromagnetic waves, Antenna lobes, Antenna feeds.

Maxwell's equations are solved in prolate spheroidal (PS) coordinates subject to the boundary conditions. The PS functions are expressed in the form of power series and Laurent series. Radiation patterns were obtained for PS transmitting antennas of three different lengths up to about one wavelength long, for length/thickness ratios of about 5/1, 10/1, 22/1, and 316/1, and for nine unsymmetrical gap locations as well as for the symmetrically-fed cases. It was found that the two most important factors affecting the radiation pattern of a fairly thin antenna were the location of the gap and the electrical length. For antennas less than a half wavelength long the pattern was the usual symmetrical figure eight and was essentially independent of the location of the gap (except for magnitude changes due to the different gap impedances). For antennas two-thirds to three-quarters of a wavelength long the figure eight patterns could be 'bent' in the direction of the longer element, and for antennas one wavelength long or longer minor lobes began to appear. (Author)

AD-604 669 Div. 8, 1, 12
OTS Prices: HC $2.00/MF $0.50

Instrumentation Lab., Mass. Inst. of Tech., Cambridge.
A MINIATURE COLD PLATE HEAT EXCHANGER FOR AN ELECTRONIC PACKAGE,
by Richard M. Jansson. 6 Apr 60, 46p E-922
Contract AF04 647 303
Unclassified report

Descriptors: (*Electronic equipment, Airborne), (*Modules (Electronic), Cooling), (*Packaged circuits, Cooling), Airborne, Heat exchanges, Liquid cooled, Water, Air cooled, Miniature electronic equipment, Heat transfer, Tests, Measurement, Construction, Test equipment, Thermocouples, Design, Inertial guidance.

This report contains the results of an investigation into the design and development of a small light-weight water-cooled cold plate for installation in airborne electronic packaging. Simplified thermal studies are included, showing the excellent correlation between the thermal performance based on the data from extensive thermal tests and the theoretical thermal performance. (Author)

AD-604 670 Div. 8
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
AN INTRODUCTION TO INFORMATION THEORY,
by Michael Marcus. Jul 62, 25p P-2609
Unclassified report

Descriptors: (*Communication theory, Mathematical analysis), Probability, Statistical functions, Functions, Communication systems, Interference, Signals, Circuits, Theorems, Coding, Theory.

Information theory is concerned with developing a framework for the study of communication systems and their capacity to transmit messages in the presence of natural disturbances. The information function or entropy of a message source gives a quantitative measure of the usefulness of the source for transmitting messages. The capacity of the channel over which the message is being transmitted, gives a measure of the most efficient communication of information possible under given conditions. This subject is developed in a purely mathematical fashion and by making reference to descriptive concepts in electrical engineering.

AD-604 687 Div. 8
OTS Prices: HC $1.00/MF $0.50

Aerospace Corp., Los Angeles, Calif.
OSCILIATOR STABILITY,
by Jean A. Develet, Jr. 26 Aug 64, 15p
TDR-269(9990)-9
Contract AF04 695 269
SSD TDR64 152
Unclassified report

Descriptors: (*Oscillators, Stability), (*Mathematical analysis, Oscillators), Integral transforms, Integration, Electron tubes, Frequency, Errors, Analysis, Integral equations.

This paper relates the conventional definition of oscillator stability to the more fundamental frequency error process of the oscillator through an integral equation. Both short- and long-term stability are encompassed by the definition. Since in general the integral equation cannot be solved, certain frequency error processes are postulated, and the stability is derived therefrom. (Author)

AD-604 690 Div. 8, 25
OTS Prices: HC $2.00/MF $0.50

Quantum Electronics Lab., Calif. Inst. of Tech., Pasadena.
ROTATIONAL MODES IN SPHERICAL-MIRROR RESONATORS.
Scientific rept. no. 2,
by Walter A. Specht, Jr. Jun 64, 46p
Contract AF49 638 1322
AFOSR 64 1311
Unclassified report

Partly supported by the Howard Hughes Doctoral Fellowship Program.

Descriptors: (*Resonators, Mirrors), (*Mirrors, Resonators), Lasers, Cavity resonators, Electromagnetic properties, Special functions (Mathematical).

This work is the examination of a cavity mode approach to the mode structure of a laser. The solution of the vector wave equation for rotational fields in and between oblate spheroidal cavities are examined for the case of wavelengths much less than cavity dimensions. These

Contracts AF19 604 1847, Nonr225 24, Nonr225 40.

Descriptors: (*Electron tubes, Scientific research), (*Electronics, Scientific research), Traveling wave tubes, Electric currents, Plasma physics, Backward-wave oscillators, Backward-wave amplifiers, Masers, Microwave equipment, Parametric amplifiers, Magnetrons, Circuits, Electron beams, Noise (Radio), Electrostatics, Klystrons, Electron guns, Frequency, Electronic equipment, Reports.

The status of all unclassified electron devices research carried on by the Stanford Electronics Laboratories is reported.

AD-604 512 Div. 8
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
PATH-INVARIANT COMMA-FREE CODES,
by William B. Kendall and Irving S. Reed.
19 Jul 61, rev. Sep 61, 23p P-2377-1
Unclassified report

Revision of P-2377 (same title) by Irving S. Reed.

Descriptors: (*Communication theory, Coding), (*Coding, Communication theory), Mathematical analysis.

The paper defines a subclass of comma-free codes which has a property called path invariance. Certain path invariant comma-free dictionaries using K symbols to form n-symbol words are developed and their properties are studied. The main advantage of this class of comma-free codes lies in the ease of establishing the positions of the divisions between words. (Author)

AD-604 527 Div. 8, 5
OTS Prices: HC $2.00/MF $0.50

Electronic systems Div., Air Force Systems Command, Bedford, Mass.
AN INSTANTANEOUSLY-RESPONDING EXPANSION AMPLIFIER: A METHOD AND DEVICE FOR SIGNAL ENHANCEMENT IN NOISY COMMUNICATION SYSTEMS,
by Laurence E. Orne and Stephen E. Stuntz.
Jul 64, 30p
Proj. 2808, Task 280801
ESD TDR64 506
Unclassified report

Descriptors: (*Data transmission systems, Amplifiers), (*Amplifiers, Nonlinear systems), Communication systems, Noise, Background, Signal-to-noise ratio, Gain, Computers, Signals, Circuits, Audiofrequency, Amplitude modulation, Experimental data, Radio teletype systems, Design.

A variable-gain amplifier having instantaneous response-time has been designed, constructed and tested, to enable recovery of a usable audiofrequency signal from noisy analog and digital systems. For 1-dB increments in signal-level at or above -40 dBm, this device will provide increments on the order of 5 dB, over the frequency-range 50 to 10,000 cps. The rise and decay envelope is apparently symmetrical, with slopes approximating one millisecond. This report discusses design features, including a modification for analog speech signals, and gives detailed results of laboratory and field tests. (Author)

AD-604 547 Div. 8, 1
OTS Prices: HC $3.00/MF $0.75

Motorola, Inc., Scottsdale, Ariz.
THERMAL DESIGN EVALUATION STUDY.
Final study phase rept.,
by J. R. Baum and R. J. Jimenez. 1 Feb 61, 90p
WF2472-1
Contract NOas60 6030c
Unclassified report

Descriptors: (*Electronic equipment, Airborne), (*Aircraft equipment, Cooling), (*Cooling, Electronic equipment), Heating, Heat exchangers, Air cooled, Coolants, Heat transfer, Temperature, Weight, Reliability (Electronics), Specifications, Test methods, Measurement, Military requirements, Design, Equations.

This report discusses the conclusions reached in the first phase of a program to develop thermal evaluation techniques for airborne electronic equipment. The need for organized thermal data acquisition and presentation is established. Recommended techniques are developed for thermal testing, data reduction and analysis. Emphasis is placed on the relationship of equipment cooling parameters to aircraft performance penalties. A preliminary draft of a military specification for the thermal design performance evaluation of airborne electronic equipment is submitted as an enclosure to this report. (Author)

AD-604 586 Div. 8, 25
OTS Prices: HC $3.00/MF $0.75

Naval Ordnance Lab., White Oak, Md.
MICROCIRCUITS IN PERSPECTIVE,
by J. E. Swanekamp and A. J. Cote, Jr. 2 Jun 64, 63p
NOL TR64 89
Unclassified report

Descriptors: (*Microminiaturization (Electronics), Circuits), (*Circuits, Microminiaturization (Electronics)), (*Integrated circuits, Microminiaturization (Electronics)), Subminiature electronic equipment, Networks, Semiconducting films, Semiconductor devices, Amplifiers, Gates (Circuits), Design, Tests, Performance (Engineering), Reviews.

General information on integrated and thin film circuits is given along with some detailed fabrication techniques and test results on sample circuits. A general discussion of microelectronic capabilities from a circuit designer's point of view is also presented along with recommendations and conclusions. (Author)

AD-604 588 Div. 8
OTS Prices: HC $3.00/MF $0.75

Westinghouse Electric Corp., Elmira, N. Y.
DESIGN AND DEVELOPMENT INVESTIGATIONS OF A LOW NOISE, LINEAR, VARIABLE GAIN, R.F. AMPLIFIER TUBE.
Quarterly progress rept. no. 4, 1 Apr-30 Jun 64,
by J. P. Pietrizyk, A. van der Jagt, and R. L. Pear.
30 Jul 64, 64p
Contract NObsr89530, Proj. SS296004, Task 7481
Unclassified report

Descriptors: (*Radiofrequency amplifiers, Electron tubes), (*Electron tubes, Radiofrequency amplifiers), Noise (Radio), Radio receivers, Cathodes (Electron tubes), Gain, Radiofrequency, Automatic gain control, Distortion, Mixers (Electronic), Design, Electron tube parts, Sensitivity, Measurement.

This experimental work has been directed towards the design and development investigations of a low noise, linear, variable gain, RF amplifier tube with improved linear dynamic range (signal handling capacity) for the

See also AD-416 724.

Descriptors: (*Radio signals, Sequential analysis), (*Detection, Communication, theory), (Sequential analysis, Signal-to-noise ratio), Radio signals, Noise (Radio), Probability, Statistical tests, Stochastic processes, Sampling, Theory.

Three problems involving sequential detection are considered in this study: (1) canonical forms for weak-signal, or threshold detection; (2) conditions for the singularity and non-singularity of optimum detection procedures for normal noise in normal noise; and (3) useful experiments involving binary sequential detection, particularly where analytic results are not obtainable. Canonical expressions for locally optimum receivers are obtained for the sequential detection of general classes of signals in general classes of noise when the cost functions are linear in sample-size. It is shown that the necessary and sufficient conditions for singularity and non-singularity for the sequential (likelihood) discrimination of one normal noise process, N sub 1, vs another, N sub o, is the same as that for the fixed-sample cases, with the additional observation that these results are to be understood as holding on the average, since now the (finite) interval (sample-size), T, is a random variable. A series of experiments involving sequential detection of signals in noise is also described and outlined in general form.

AD-604 748 Div. 8, 15, 30
OTS Prices: HC $1.00/MF $0.50

Michigan Univ., Ann Arbor. Coll. of Literature, Science, and the Arts.
VARIANTS OF THATCHER'S ALGORITHM FOR CONSTRUCTING PULSERS.
Technical rept.,
by S. Hedetniemi. Aug 64, 20p ORA-03105-29-T
Contract Nonr1224 21, Proj. 03105

Unclassified report

Descriptors: (*Pulse generators, Delay circuits), (*Numerical methods and procedures, Electronics), Mathematical models, Input-output devices, Electromagnetic pulses, Sequences, Computer logic, Mathematical logic, Automata.

AD-604 752 Div. 8, 6
OTS Prices: HC $2.00/MF $0.50

Aerospace Corp., Los Angeles, Calif.
RADAR MAPPING OF DISTRIBUTED TARGETS,
by A. W. Rihaczek. 1 Jul 64, 32p TDR-269(4250-43)-3
Contract AF04 695 269
SSD TDR64 108

Unclassified report

Descriptors: (*Radar, Mapping), (*Mapping, Radar), Radar targets, Distribution, Radar clutter, Radar interference, Radar signals, Doppler effect, Resolution, Matched filters, Sampling, Integral transforms, Equations.

Conventional radar theory deals with point targets, and though a distributed target must necessarily be composed of a large number of point scatterers there remain some doubts as to how applicable the existing theory is to continuous target distributions. The study starts with a brief justification of the target model used, and then invokes the sampling theorem to show under what conditions the continuous distribution can be replaced by an equivalent set of point targets, so that conventional theory can be employed to analyze the resolution problem. In this process it becomes apparent that the common definition of resolution, the half-power width of the receiver response, is not satisfactory for high-performance radar. Instead of a single quantity, four 'indices of resolution' are needed for an adequate description of the resolution performance of a radar.

AD-604 755 Div. 8
OTS Prices: HC $2.00/MF $0.50

Microwave Associates, Inc., Burlington, Mass.
MAGNETICALLY CONTROLLED GAS DUPLEXER.
Quarterly progress rept. no. 4, 27 Nov 63-27 Feb 64,
by C. S. Ward. Aug 64, 46p
Contract AF30 602 2960, continuation of Contract AF30 602 2401, Proj. 5573, Task 557301
RADC TDR64 229

Unclassified report

See also AD-436 346

Descriptors: (*Radar duplexers, Gas discharges), (*Discharge tubes, Radar duplexers), Magnetic fields, Pressure, Cavity resonators, Electric arcs, Microwave equipment, Electron tubes.

Measurements of discharge arc loss in helium as a function of gas pressure and transverse magnetic field are described. The discharge tube was incorporated in a cavity resonator and loss measurements were made by monitoring the cavity gain at resonance. Results indicate that for p sub o< or = 1 Torr, magnetic fields in excess of 600 gauss will produce 60-70% reductions in discharge arc loss. The power levels at which data were obtained are extrapolated to show that the results are valid for balanced ATR duplexing at 45 megawatts peak - 75 kilowatts average. Clean-up considerations based on the measured arc loss reductions indicate that by use of magnetic fields, the usable life of low pressure gas filled duplexers can be extended at least an order of magnitude beyond the present state-of-the-art. Progress is construction of an experimental model of a magnetic field duplexer is also described. (Author)

AD-604 857 Div. 8, 6
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
COHERENT DETECTION OF RADAR RETURNS OF UNKNOWN DOPPLER SHIFT,
by Ivan Selin. Aug 64, 36p RM-4227-PR
Contract AF49 638 700

Unclassified report

Descriptors: (*Coherent radar, Doppler effect), (*Radar tracking, Doppler effect), Radiofrequency filters, Signal-to-noise ratio, Search radar, Position finding, Radar receivers, Radar pulses, Design, Mathematical analysis, Phased arrays, Detection.

This Memorandum presents a solution to the problem of detection by phase-coherent techniques of radar returns of unknown Doppler shift, a problem that has been approached by various approximate methods for several years. In addition, the Memorandum contains a discussion of these earlier approaches and the circumstances in which they are useful. A discussion of the filter design, as well as the mathematical derivation of the desired filter operation, is included. The filter is also suitable for sequential detection, a field that is growing in potential value with the advent of phased array radars. (Author)

AD-604 888 Div. 8, 25
OTS Prices: HC $4.00/MF $0.75

Texas Instruments, Inc., Dallas.
OPTOELECTRONIC FUNCTIONAL ELECTRONIC BLOCKS.
Interim engineering rept. no. 4, 1 May-31 Jul 64,
by J. R. Biard. 27 Aug 64, 116p TII-03-64-56
Contract AF33 657 11552

Unclassified report

See also AD-603 409.

solutions are rotational field modes in Fabry-Perot type resonators with equal-radius concave spherical mirrors, or with concave-convex spherical mirrors, when the parameters of the oblate spheroids are chosen so that the radii of curvature and spacing on the axis of rotation match those of the resonator mirrors. Expressions for the transverse and longitudinal rotational mode structures are derived. The eigenvalue equations are written, and are solved for the case of the two lowest order modes. (Author)

AD-604 692 Div. 8, 26
OTS Prices: HC $1.00/MF $0.50

Sprague Electric Co., North Adams, Mass.
PRODUCTION ENGINEERING MEASURE RELIABILITY IMPROVEMENT: JET ETCH TRANSISTOR.
Quarterly rept. no. 7, 31 Oct 63-31 Jan 64,
by J. N. Edwards, J. H. D. Folster, and R. M. Gagne.
31 Jan 64, 13p
Contract DA36 039SC86721
Unclassified report

See also AD-400 330

Descriptors: (*Transistors, Manufacturing methods), Etched crystals, Reliability (Electronics), Production, Tests, Test methods, Data, Germanium.

The purpose of this contract is to provide the engineering for improvement of production techniques to increase the reliability of the jet etch transistor Type 2N1500. Data establishing the reliability of the jet-etch transistor at <.044%/1000 hr are presented. The adaptability of the Isub CBO method of monitoring delineation to production was further verified.

AD-604 727 Div. 8
OTS Prices: HC $3.00/MF $0.75

Syracuse Univ., N. Y. Research Inst.
SIDELOBE REDUCTION AND GAIN CHARACTERISTICS OF PARTIALLY UNIFORM ANTENNA ARRAYS.
Task rept. no. 9,
by Bradley J. Strait and David K. Cheng.
Aug 64, 96p EE-957-6405T9
Contract AF30 602 2646, Proj. 4506, Task 450604
RADC TDR64 243
Unclassified report

Descriptors: (*Antenna lobes, Inhibition), (*Antenna radiation patterns, Control), Antennas, Excitation, Gain, Electromagnetic waves, Polynomials.

It has been found that sidelobe reduction can be effected by properly adjusting the excitation amplitudes in the outermost elements of a uniform array. The report presents a systematic method for determining these amplitudes exactly. The method can be applied to both broadside and endfire arrays, and can be used to eliminate radiation in any particular direction. By forcing a controlling factor to be a Chebyshev polynomial, a given amount of sidelobe suppression throughout the visible range can be guaranteed. Compared to Dolph-Chebyshev arrays designed for a certain range of sidelobe levels, partially uniform arrays offer higher directive gains and lower maximum-to-minimum amplitude ratios as well as much simpler excitation requirements. By suitably adjusting the excitation amplitudes, it is also possible to create a null in the pattern of a partially uniform array in any specified direction. Several modified techniques are discussed and numerous illustrative examples are given. (Author)

AD-604 732 Div. 8, 26
OTS Prices: HC $3.00/MF $0.75

ITT Electron Tube Div., Roanoke, Va.
PRODUCTION ENGINEERING MEASURE FOR TYPE FW-202 BARRIER GRID STORAGE TUBE.
Quarterly progress rept. no. 10, 1 Oct-31 Dec 63,
by D. D. Duggan. 31 Dec 63, 59p ITT-3235A
Contract DA36 039sc85967
Unclassified report

Descriptors: (*Storage tubes, Production), Coatings, Glass, Copper, Nickel, Evaporation, Tests, Electron beams, Cathode ray tube screens, Electron guns, Electrodes, Specifications.

Three barrier grid tubes were assembled and exhausted, one of which meets all test specifications. The beam current problem reported in AD-434 067 appears to be a design problem. Processes which are now standard manufacturing procedures include target bond manufacture, electrophoretic coating and vitrification of SG-67 Glass Frit, settling and vitrification of 0120 Glass Frit, copper thickening of screens, nickel and glass evaporations, target bonding, collector section assembly and dynode oxidation. Process specifications were written for all of these procedures. (Author)

AD-604 734 Div. 8, 26
OTS Prices: HC $2.00/MF $0.50

General Electric Co., Auburn, N. Y.
THE IMPROVEMENT OF PRODUCTION TECHNIQUES TO INCREASE THE RELIABILITY OF DIFFUSED SILICON CONTROLLED SWITCHES TYPES 2N689.
Quarterly progress rept. no. 4, 1 Apr-30 Jun 64,
by J. N. Frank, A. Hishta, R. C. Rome, H. Wawrousek, and W. R. Comstock. 30 Jun 64, 43p
Contract DA36 039AMC03619E
Unclassified report

See also AD-601 442

Descriptors: (*Semiconductor devices, Electronic switches), (*Electronic switches, Production), (*Crystal rectifiers, Production), Silicon, Gold, Diffusion, Welding, Ultrasonic radiation, Scheduling, Tests, Surface properties, Stability, Cathodes, Crystal growth, Reliability (Electronics), Management control systems.

The report covers work performed on the device package ultrasonic welding, the tests being conducted to determine the optimum tubulation weld schedules, the evaluation of completed high-speed low-voltage all-diffused devices, the experiments conducted to re-establish gold diffusion conditions, the comparison of material from four different N-type silicon crystals and their effect on pulse turn-off times, and the summary of blocking voltage step stress test data on the alloy-diffused device. A PERT analysis depicts the progress of this program, and provides for certain conclusions based upon the work performed. (Author)

AD-604 740 Div. 8, 5, 6
OTS Prices: HC $3.00/MF $0.75

Carlyle Barton Lab., Johns Hopkins Univ.,
Baltimore, Md.
SEQUENTIAL DETECTION II,
by David Middleton. Jul 64, 63p
Contract AF30 602 2597, Proj. 4505, Task 450501
RADC TDR64 195
Unclassified report

(*Communication theory, Noise (Radio)), Statistical processes, Probability, Distribution theory, Functional analysis, Differential equations, Integral equations.

The problem of finding the probability distribution of a functional, consisting of a (multi-dimensional) Markoff process and a given function, appears in many forms in the theory of noise and other random phenomena. It is shown that a certain function from which this probability distribution can be obtained is the unique solution of two integral equations. A perturbation formalism which relates the solutions of the integral equations belonging to two different functions is developed. If the transition probability density is the principal solution of two partial differential equations of the Fokker-Planck-Kolmogoroff type, the principal solution of two similar differential equations is the solution of the integral equations. As an example the probability distribution of the sample probability density for a stationary Markoff process is calculated. (Author)

AD-604 988 Div. 8, 26
OTS Prices: HC $2.00/MF $0.50

Linde Div., Union Carbide Corp., Cleveland, Ohio.
PRODUCTION ENGINEERING MEASURE FOR THE IMPROVED RELIABILITY OF SOLID TANTALUM CAPACITORS.
Quarterly progress rept. no. 4, 1 Apr-30 Jun 64, by J. E. Riley. 30 Jun 64, 38p
Contract DA36 039AMC03624E
Unclassified report

See also AD-601 302.

Descriptors: (*Tantalum capacitors, Manufacturing methods), Reliability (Electronics), Electrolytes, Tantalum, Powder metals, Impregnation, Encapsulation, Life expectancy, Performance (Engineering), Electrical properties, Lasers, Welding, Production.

A summary is presented herein of all experimental results and activities to date. Chronological plots are presented, showing that much progress has been made in improving capacitor yields, dc leakage current, and failure rates. Tabulated data are presented, giving pertinent results for every experiment performed thus far under the engineering studies. Other plots are included which depict phenomena associated with the formation and reformation processes. (Author)

AD-604 995 Div. 8
OTS Prices: HC $2.00/MF $0.50

Microwave Electronics Corp., Palo Alto, Calif.
DEVELOPMENT OF PPM-FOCUSED LOW-NOISE TRAVELING-WAVE TUBES FOR Ku-, K-, AND Ka-BAND.
Interim development rept. no. 1, 1 Jul-30 Sep 63. Oct 63, 26p
Contract NObsr89323, Proj. SR0080304, Task 9293
Unclassified report

Descriptors: (*Traveling wave tubes, K band), Electron guns, Helixes, Magnets, Focusing, Noise (Radio), Design, Impedance matching, Performance (Engineering), Magnetic fields, Gain.

Work during the reporting period included the following tasks. The initial gun design was completed. Jigs, fixtures, and special straightening techniques were made for cathode-gun alignment. The RF performance of the tubes was studied, and a gold-plated helix design was chosen. The helix characteristic impedance variation for RF matching was studied, and the resultant impedance transformer design produced VSWR < 2 from 10.5 to 16.5 Gc for four matched helices. The RF tests of existing MEC Ku- and Ka-band tubes provided reference data for tube design. (Modification of current MEC tubes will be possible.) Preliminary design of the PPM-focusing array was completed. (Author)

Descriptors: (*Semiconductor devices, Integrated circuits), (*Integrated circuits, Semiconductor devices), Electron optics, Coupling circuits, Pulse amplifiers, Optical glass, Gallium alloys, Arsenides, Spectrum analyzers, Light transmission, Modules (Electronic).

The program has been divided into two tasks. Task I covers the design and fabrication of Optoelectronic Functional Electronic Blocks. The first Optoelectronic Pulse Amplifiers (OPA) were fabricated during this report period. A high percentage of the amplifier bars were operable, with component values well within the required tolerances. With the exception of low-temperature cracking of the optical coupling glass the design goals of the OPA have been met. Task II is concerned with the development of semiconductor and measurement technology necessary to adequately implement the Optoelectronic Functional Electronic Blocks selected for study. The technology and measurement investigations reported under Task II include: (A) The evaluation of several high-index glasses for use as optical coupling media; (B) the measurement of transient rise time of light output from GaAs IR sources; (C) the characteristics of GaAsP light emitters; (D) the description and characterization of an improved IR spectrometer detection system; (E) the description of a new planar etching technique for the 'A' face of 111 oriented GaAs; and (F) the characteristics of GaAs guard-ring diodes. (Author)

AD-604 890 Div. 8
OTS Prices: HC $2.00/MF $0.50

Lincoln Lab., Mass. Inst. of Tech., Lexington.
LIMITATIONS OF OXIDE-CATHODE HIGH CURRENT DENSITY OPERATION.
Technical rept.,
by H. A. Pike. 22 May 64, 26p LL-TR-356
Contract AF19 628 500, ARPA Order 85
ESD TDR64 332

Unclassified report

Descriptors: (*Cathodes (Electron tubes), Electrical properties), Electron tube parts, Coatings, Oxides, Dissociation, Sparks, Electromagnetic pulses, Transients, Thermal properties, Work functions, Resistance (Electrical), Diodes(Electron tubes), Photomultipliers.

Microsecond pulsed current from a good oxide cathode at normal operating temperatures is often limited by sparking rather than by saturation of cathode emission. Measurements were made of the current at which sparking occurs for pulse lengths between 0.5 and 500 micro-sec. Also, the fast time response of photomultiplier tubes sensitive in the near infrared allowed the measurement of temperature transients on the cathode surface during and after the pulse. It was found that the current which caused a fixed cathode surface temperature rise was dependent upon pulse length, as was the sparking current. The supposition is made that, for short pulses, sparking is associated with the thermal dissociation of the cathode coating surface due to joule heat generated by the passage of current through the high resistance layer at the surface of the coating. Increasing the anode temperature decreased both the cathode work function and coating resistance. Using this technique, current density in excess of 200 amp/s cm was dran without sparking. (Author)

AD-604 896 Div. 8
OTS Prices: HC $3.00/MF $0.75

Electrical Engineering Research Lab., Univ. of Texas, Austin.
A MILLIMETER WAVELENGTH FREQUENCY STANDARD.
Technical rept. no. 8,
by H. D. Holden. 10 Aug 64, 66p
Contract AF33 657 8716, Proj. 4062

Unclassified report

Descriptors: (*Millimeter waves, Standards), (*Microwave frequency, Standards), Extremely high frequency, Resonance absorption, Temperature control, Harmonic oscillators, Varactor diodes, Crystal rectifiers, Crystal oscillators, Klystrons, Waveguides, Frequency multipliers, Nonlinear systems, Design, Radiofrequency spectroscopy.

This report describes the development of a millimeter wavelength frequency standard. A very stable one gigacycle signal, generated by a crystal controlled oscillator, is harmonically multiplied in two stages resulting in a very stable signal in the 50 to 60 gigacycle frequency range. The first section includes an introduction to radio spectroscopy, the field of investigation in which the frequency standard can be most effectively used. In the second section theoretical aspects of harmonic generation are considered. The third and final section is a description of the frequency standard and an account of the investigations leading to its completion. (Author)

AD-604 900 Div. 8, 16
OTS Prices: HC $5.00/MF $1.00

Bissett-Berman Corp., Santa Monica, Calif.
RF RADIATION HAZARD DETECTION AND WARNING DEVICES: PHASES I AND II.
Final engineering rept.
30 Jun 64, 170p C34-35
Contract Nobsr87467, Proj. SF013 01 07, Task 2091

Unclassified report

Descriptors: (*Microwaves, Radiation hazards), (*Integrators, Microwave frequency), Detectors, Radiofrequency, Monitors, Warning systems, Portable, Electroplating, Radar equipment, Omnidirectional antennas, Circuits, Health physics.

Recognition that physiological damage caused by microwave radiation is a function of the time of exposure as well as the level of power density required the development of an RF radiation integrator. Phase I of the program resulted in an integrating Microwave Radiation Hazard Detector which accumulates incident electromagnetic energy over a 30-second interval and reads out the total value on a counter. Phase II of the program resulted in a ruggedized, portable, battery-operated RF radiation integrator which accumulates incident electromagnetic energy over a 30-second interval and actuates first, second or third level visible and audible alarms when total energies exceed 0. 3, 0. 6, and 3. 0 joules/sqcm, respectively. Both instruments utilize E-CELL integration techniques. The E-CELL is a new electrolytic component in which transfer of a platable material between electrodes is proportional to the incident energy. The program included studies and procurement of antennae which were circularly polarized and which approximated hemispherical coverage. (Author)

AD-604 947 Div. 8, 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A SYSTEMATIC APPROACH TO A CLASS OF PROBLEMS IN THE THEORY OF NOISE AND OTHER RANDOM PHENOMENA,
by D. A. Darling and A. J. F. Siegert.
10 Sep 55, 22p P-738

Unclassified report

Prepared in cooperation with Michigan Univ., Ann Arbor and Northwestern Univ., Evanston, Ill.

Descriptors: (*Noise (Radio), Numerical analysis),

AD-604 650 Div. 9, 1
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
AN AEROELASTIC PARAMETER FOR ESTIMATION OF THE EFFECTS OF FLEXIBILITY ON THE LATERAL STABILITY AND CONTROL OF AIRCRAFT,
by W. P. Rodden. 14 Apr 55, 13p P-654
Unclassified report

Descriptors: (*Aeroelasticity, Roll), (*Aerodynamic control surfaces, Aeroelasticity), Stabilization, Ailerons, Deformation, Series, Deflection, Equations, Aerodynamic loading, Wings, Flight control systems.

The importance of the estimation of flexibility effects on the maneuvering performance of an aircraft is known from the losses in lateral control and stability at high speeds. An aeroelastic parameter is introduced in a quasisteady analysis which separates the effects of Mach number from those of altitude on the lateral motion of a flexible wing. Its use is demonstrated by an application to a wing with one degree of freedom in roll and it is shown that the conventional stability derivatives can be modified to include the steady-state effects of flexibility. The determination of aileron reversal speed and applications for preliminary design are discussed. (Author)

AD-604 655 Div. 9, 30
OTS Prices: HC $3.00/MF $0.75

Arnold Engineering Development Center, Arnold Air Force Station, Tenn.
TRANSONIC BLOCKAGE INVESTIGATION OF A PROPOSED DYNAMIC WIND TUNNEL MOUNT (MODEL FLY PROGRAM, USAF),
by R. I. Lowndes. Aug 64, 60p
Contract AF40 600 1000
AEDC TDR64 173
Unclassified report

Descriptors: (*Transonic characteristics, Model tests), Transonic wind tunnels, Wind tunnel models, Supports, Inhibition, Gas flow, Aerodynamic characteristics, Pressure, Distribution, Statics.

An aerodynamic blockage investigation was conducted on a 1/16-scale model of a dynamic wind tunnel mount proposed for the Propulsion Wind Tunnel, Transonic (16T). The investigation was performed from Mach 0.60 to 1.50. The results are presented in terms of test section wall suction required to establish Mach number and static pressure distributions in the vicinity of the model. A maximum effective model blockage of approximately 4 percent occurred at Mach 1.00 to 1.10. Wall suction requirements were apparently within the maximum suction capabilities available for the Tunnel 16T. No severe pressure disturbances were measured in the proposed model location. (Author)

AD-604 749 Div. 9, 15
OTS Prices: HC $3.00/MF $1.00

Space Sciences Lab., General Electric Co., Philadelphia, Pa.
A DISCRETE ORDINATE TECHNIQUE FOR THE LINEARIZED BOLTZMANN EQUATION WITH APPLICATION TO COUETTE FLOW,
by B. B. Hamel and M. Wachman. Aug 64, 80p
R64SD53
Contract AF49 638 1283
Unclassified report

Descriptors: (*Numerical methods and procedures, Couette flow), (*Couette flow, Numerical analysis), (*Superaerodynamics, Numerical methods and procedures), Integral equations, Differential equations, Boundary value problems, Spheres, Molecules, Statistical functions, Integrals, Integration.

A numerical method for the solution of the linearized Boltzmann equation of hard sphere molecules is developed here, in which approximations are made only in sense of numerical truncations. The distribution function is considered at n discrete points in velocity space, and a closed symmetric set of differential equations is developed which describe the evolution of the distribution function at each of these discrete points. The key point of the method is the approximation, by a finite sum, of the collision integral, utilizing Gauss quadrature (integration) formulas. The method is applied to the problem of linearized Couette flow of hard sphere molecules. Numerical results are obtained for the moments and for the perturbation distribution function at the discrete points. (Author)

AD-604 783 Div. 9
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE LAMINAR BOUNDARY LAYER ON A CONE IN A SUPERSONIC AIR STREAM AT ZERO ANGLE OF ATTACK,
by W. Hantzsche and H. Wendt. 13 Nov 47, 8p T-6
TT 64-71277
Unclassified report

Trans. of mono. die Laminare Grenzschicht bei einem mit Uberschallgeschwindigkeit Angestromtem Nichtangestellten Kreiskegel, n.p., n.d.

Descriptors: (*Laminar boundary layer, Conical bodies), (*Conical bodies, Laminar boundary layer), (*Supersonic flow, Conical bodies), Differential equations, Integration, Angle of attack, Flat plate models, Heat transfer coefficients, Shock waves, Friction, Pressure.

This report demonstrates that the integration of the equations for the laminar boundary layer on a cone in a supersonic air stream can be reduced to the equations for the flat plate. The simple result is obtained, that on the cone the boundary layer is different by 1/square root of 3 as compared to the plate. The mean friction coefficient and the heat transfer coefficient are greater by the factor 2/3 times the square root of 3. (Author)

AD-604 789 Div. 9
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
OPTIMUM SHAPES FOR AXIALLY SYMMETRICAL SUPERSONIC THRUST NOZZLES,
by G. Guderley and E. Hantsch. 4 Sep 47, 44p T-1
TT 64 71283
Unclassified report

Trans. of unidentified German language mono., n.p., n.d. Prepared in cooperation with Douglas Aircraft Co., Inc., Santa Monica, Calif.

Descriptors: (*Supersonic nozzles, Geometric forms), Design, Axially symmetric flow, Supersonic flow, Thrust, Partial differential equations, Mathematical analysis.

A determination was made of shapes of nozzles which, at a given mass rate of flow, given length, and given exit cross section, produce maximum thrust. The minimum sector is predetermined rather accurately by the mass

9. Fluid Mechanics

AD-604 430 Div. 9
OTS Prices: HC $3.00/MF $0.75

General Applied Science Labs., Inc., Westbury, N. Y.
LINEARIZED APPROXIMATIONS TO THE BOUNDARY LAYER EQUATIONS,
by Joseph A. Schetz and Joseph Jannone. Jun 64, 74p GASL-TR-448
Unclassified report

Prepared for AFOSR.

Descriptors: (*Boundary layer, Equations), (*Fluid flow, Theory), Viscosity, Differential equations, Nonlinear differential equations, Transformations (Mathematics), Functions, Integral equations, Velocity, Pressure.

The general subject of linearized approximations to the boundary layer equations as a source of approximate solutions for viscous flow problems is considered from a unified viewpoint. The various methods based upon this concept which have been proposed in the literature are reviewed and applied to two specific non-similar flow problems in order to affect a comparison of quantitative results. Within this framework some new work is presented. Linearization in the von Mises plane is considered in some detail, and typical results are compared with those obtained by the conventional physical plane linearization techniques. In this regard, the use of the total pressure rather than the velocity as the dependent variable is shown to have important advantages, both conceptual and quantitative, even for constant pressure flow problems when subjected to a linearized treatment. Finally, specific recommendations are made as to the approach best applied to a specific type of physical problem. (Author)

AD-604 510 Div. 9, 22
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
NUMERICAL SOLUTIONS OF SPHERICAL BLAST WAVES,
by H. L. Brode. 18 Jul 55, 35p P-571-AEC (supp.)
Unclassified report

Descriptors: (*Shock waves, Numerical analysis), (*Graphics, Shock waves), Explosion effects, Mechanical waves, Propagation.

Numerical solutions of spherical blast waves are illustrated by means of graphs.

AD-604 548 Div. 9
OTS Prices: HC $1.00/MF $0.50

Naval Research Lab., Washington, D. C.
STUDY OF WAVES IN A SMALL TANK.
Interim rept.,
by W. L. Roberts. 29 Jul 64, 13p
NRL 6097
Unclassified report

Descriptors: (*Water waves, Tanks (Containers)), Hydrodynamics, Photographic analysis.

With the use of relatively simple apparatus, precise measurements were made of wavelength and attenuation versus frequency of surface waves in the transition region between gravity waves and capillary waves. Wave velocities were determined by measuring the wavelengths in photographs of the water surface. The effects of contamination of velocity and attenuation were determined. The effect of a current flowing perpendicular to a capillary wave system was studied photographically. Below a surface velocity of 6 centimeters per second, the cross current has little effect on wave structure. In the velocity range from 6 to 10 centimeters per second severe distortion of wave shape, and even destruction of the entire wave train, may result. The attenuation with distance of wave amplitudes was measured for wavelengths from 0.75 to 4 centimeters. The measured values of attenuation in this wavelength range, obtained with distilled water and a clean surface, are only 6 percent more than the theoretical values. Tap water gave values as much as a factor of five larger than the theoretical values. (Author)

AD-604 562 Div. 9
OTS Prices: HC $2.00/MF$0.50

RAND Corp., Santa Monica, Calif.
THE BLAST FROM A SPHERE OF HIGH PRESSURE GAS,
by H. L. Brode. 27 Jan 55, 30p P-582
Unclassified report

Presented at the American Physical Society Meeting 27-29 Jan 55.

Descriptors: (*Gas flow, High-pressure research), (*High-pressure research, Gas flow), Shock waves, Mathematical models, Differential equations, Fluid dynamic properties, Mathematical analysis.

The gas dynamics resulting from the release of an isothermal sphere of gas initially at rest and at a high pressure are described by the numerical solution of the differential equations which represent an ideal gas in radial motion. The resulting outward shock and the inward rarefactions and shocks are described in some detail and are compared with the gas dynamics of the point-source solution. The existence of the inward moving shocks is observed in the present calculations to occur repeatedly, subjecting the origin to several compressive waves which are reflected there and which move out to overtake the main shock. (Author)

AD-604 635 Div. 9
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A SIMILARITY SOLUTION FOR A SPHERICAL SHOCK WAVE,
by Richard Latter. 3 Feb 55, 40p P-633
Unclassified report

Descriptors: (*Shock waves, Viscosity), Gas flow, Spheres, Boundary layer, Numerical analysis, Differential equations.

The point-source, spherical shock wave moving into a constant density, Gamma-law gas is considered in the limit of infinite shock strength from the point of view of the Richtmyer-von Neumann viscosity technique. A similarity solution of this problem is shown to exist and is obtained for various boundary conditions with Gamma = 1.4. The solutions are obtained analytically in that part of the flow field not involving viscosity, and numerically in the other parts of the flow field. It is found that whereas all discontinuities of the physical parameters are removed by the viscosity there remain discontinuities in the slopes of these parameters at the shock-front. It is indicated, moreover, that the complete flow field depends upon the form and magnitude of the viscosity. (Author)

AD-604 891 Div. 9
OTS Prices: HC $3.00/MF $0.75

Hydronautics, Inc., Laurel, Md.
ON A FULLY CAVITATING TWO-DIMENSIONAL FLAT PLATE HYDROFOIL WITH NON-ZERO CAVITATION NUMBER NEAR A FREE SURFACE,
by B. Yim. Jun 64, 60p Hydro-TR-463-4
Contract NObs90224, Proj. SS600 000, Task 1701
Unclassified report

Descriptors: (*Hydrofoils, Cavitation), (*Hydrodynamics, Hydrofoils), Lift, Experimental data, Iterative methods, Transformations (Mathematics), Fluid dynamic properties, Differential geometry.

AD-604 892 Div. 9
OTS Prices: HC $1.00/MF $0.50

Aerospace Corp., Los Angeles, Calif.
NEWTONIAN FLOW OVER A STATIONARY BODY IN UNSTEADY FLOW,
by J. W. Miles. 3 Aug 64, 22p TDR-269(4230-30)-6
Contract AF04 695 269
SSD TDR64 146
Unclassified report

Prepared in cooperation with Institute of Advanced Studies, Australian National Univ., Canberra (Australia).

Descriptors: (*Hypersonic flow, Fluid mechanics), (*Fluid mechanics, Numerical analysis), Equations, Motion, Integration, Differential equations, Boundary layer, Two-dimensional flow, Axially symmetric flow, Shock waves.

The equations governing either two-dimensional or axisymmetric, unsteady hypersonic flow over a stationary body are developed on the hypothesis of a thin shock layer. These approximate equations are integrated to obtain a formal generalization of the Newton-Busemann formula for the pressure on the body. It is found that, just as in steady flow, tangential velocity, integrated mass flux, and entropy are conserved by fluid particles within the shock layer; however, retarded-time effects render specific applications more complicated. (Author)

AD-604 933 Div. 9
OTS Prices: HC $200/MF $0.50

RAND Corp., Santa Monica, Calif.
ON THE STABILITY OF A CIRCULAR CYLINDER,
by J. L. Raymond and T. B. Garber.
Rev. 9 Jan 56, 28p P-723
Unclassified report

Descriptors: (*Cylindrical bodies, Aerodynamic characteristics), Stability, Hypersonic flow, Angle of attack, Rotation, Pitch (Motion), Damping, Equations, Mathematical analysis.

This paper deals with a single-degree-of-freedom motion of a rigid right circular cylinder, namely, rotation about any axis normal to the longitudinal axis. The two selected space orientations are such that in the first case the translational velocity vector and the longitudinal axis form the plane of rotation (end-over-endmotion), and in the second case the longitudinal axis lies in the plane of rotation which is always perpendicular to the translational velocity vector. The aerodynamic static and damping stability of the cylinder are first derived for later use in the equations of motion for each of the above-mentioned cases. Rotation of the first type (which may be coined in-plane rotation) is non-linear in nature and depends upon the aerodynamic damping characteristics as well as the initial spin rate, while rotation of the second type (coined normal rotation) is linear and logarithmically damped. (Author)

AD-604 993 Div. 9, 25
OTS Prices: HC $1.00/MF $0.50

Space Technology Labs., Inc., Los Angeles, Calif.
MAGNETOHYDRODYNAMIC EFFECTS ON BOW SHOCK,
by Wulf B. Kunkel. 5 Aug 58, 10p
STL-GM-TR-0165-00449
Contract AF04 647 165
Unclassified report

Descriptors: (*Atmosphere entry, Shock waves), (*Magnetohydrodynamics, Atmosphere entry), Gas ionization, Electrons, Temperature, Magnetic fields, Electric fields, Thermodynamics, Gas flow.

AD-605 008 Div. 9, 1
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE OPTIMUM DISTRIBUTION OF LIFT IN CERTAIN PRISMATIC REGIONS AT SUPERSONIC SPEED,
by W. W. Willmarth. 5 Mar 56, 10p P-813
Unclassified report

Descriptors: (*Supersonic flight, Lift), (*Wings, Lift), Flat plate models, Prismatic bodies, Swept-back wings, Aerodynamic characteristics.

AD-605 034 Div. 9
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE STEADY, AXIALLY SYMMETRIC FLOW OF A VISCOUS FLUID IN A DEEP ROTATING CYLINDER WHICH IS HEATED FROM BELOW,
by G. N. Lance and E. C. DeLand. 20 Nov 56, 32p P-852
Unclassified report

Descriptors: (*Fluid flow, Cylindrical bodies), (*Rotation, Heat transfer), Axially symmetric flow, Heating, Thermal conductivity, Molecular properties, Viscosity, Reynolds number, Numerical analysis, Equations.

The principal assumptions considered include transfer of heat by molecular conduction only (and not by convection), no evaporation from the surface of the fluid, elimination of the non-linear terms from the equations and certain analytic approximations.

AD-605 081 Div. 9, 1
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
NEWTONIAN FLOW THEORY FOR SLENDER BODIES,
by J. D. Cole. 13 Feb 56, rev. 25 Sep 56, 34p P-926
Unclassified report

Descriptors: (*Hypersonic flow, Slender bodies), (*Slender bodies, Hypersonic flow), Gas flow, Aerodynamic configurations, Numerical analysis, Hypersonic flight, Airframes, Design.

As an aid to the aerodynamicist in the design of air-

rate of flow; thus, the most important geometrical features of the nozzle are contained in this formulation. For the solution two separate examinations were carried out. First, the shape of the nozzle near the minimum sector was determined. Second, the supersonic section of the nozzle was determined.

AD-604 821 Div. 9
OTS Prices: HC $2.00/MF $0.50

Princeton Univ., N. J.
BOUNDARY LAYER FLOW WITH SUSPENDED PARTICLES,
by H. H. Chiu. Aug 62, 38p AER-620
Contract AF49 638 465, Proj. 9781
AFOSR 4540; N63 11957

Unclassified report

Descriptors: (*Laminar boundary layer, Laminar flow), (*Gas flow, Particles), (*Particles, Fluid dynamic properties), Colloids, Aerodynamics, Heat transfer, Velocity, Aerodynamic configurations, Mathematical analysis, Equations.

The laminar boundary layer flow with particles injected upstream of the leading edge of a plate was investigated. The boundary layer equations for the gas, and the equations governing the rate of momentum and heat transfer between the gas and the particles were solved simultaneously. A series solution was constructed in terms of a system of universal functions from which the solution for the arbitrary velocity and temperature ratio of the gas and the particles at the leading edge may be calculated. A closed form solution was obtained for the particle motion. It was found, within the validity of the approximation, that the wall shear force may be larger or smaller than that of the flow of clean gas, depending on the relative magnitude of the velocity of the particles and the gas at the leading edge; and that the wall heat transfer depends primarily on the relative magnitude of the temperature of the particles and the gas at the leading edge, and upon the wall temperature. (Author)

AD-604 822 Div. 9, 25
OTS Prices: HC $2.00/MF $0.50

Princeton Univ., N. J.
EXPERIMENTAL INVESTIGATION OF BOUNDARY LAYER TRANSITION ON A FLAT PLATE WITH A POINT HEAT SOURCE AT THE LEADING EDGE,
by W. J. McCroskey. Aug 62, 40p AER-623
Contract AF49 638 465, Proj. 9781
AFOSR 4541; N63 11958

Unclassified report

Descriptors: (*Boundary layer transition, Flat plate models), (*Flat plate models, Boundary layer transition), Heat, Aerodynamic heating, Boundary layer, Laminar flow, Turbulence, Reynolds number, Thermodynamics.

The addition of heat to the boundary layer of an insulated flat plate by means of a point heat source at the leading edge has been found to delay the transition of laminar flow to turbulence. This paper describes an experimental investigation of the variation of transition Reynolds number on a roughened flat plate model with a heat source of strength, Q, spanning the leading edge. The present problem is compared with the problem of an aerodynamically heated boundary layer on an insulated flat plate. Transition Reynolds number was found to increase with increasing S over a range equivalent to a Mach number variation of $0 < M_\infty < 0.6$. (Author)

AD-604 825 Div. 9, 25
OTS Prices: HC $5.00/MF $1.00

Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
HYPERSONIC FLOW VISUALIZATION USING THE GLOW DISCHARGE TECHNIQUE.
Master's thesis,
by John M. Fabian. Jun 64, 162p
AFIT GAM/ME/64 6

Unclassified report

Descriptors: (*Flow visualization, Hypersonic flow), (*Hypersonic flow, Flow visualization), Glow discharges, Electrodes, Axially symmetric flow, Refractive index, Absorption, Hypersonic wind tunnels, Tests, Electric discharges.

The use of an electrical discharge to obtain visualization in hypersonic flow is considered. The experimental effort was conducted in the ARL hypersonics facility using the three-inch and four-inch hypersonic wind tunnels. The electrical discharge is identified as a classical glow discharge, and its characteristics are discussed. The quality of visualization is found to depend upon electrode position relative to the stream, and model position relative to the transverse plane containing the electrodes. The effect of electrode polarity is investigated and found to be critical. The validity of the results determined by using schlieren results and Van Dyke's numerical solution for axially symmetric shock wave shapes. The effectiveness of the technique is determined by comparison of the results with those obtained using schlieren. Tests were conducted to determine the effect of the discharge on model temperature and pressure, as well as on the flow pattern as portrayed by schlieren photography. (Author)

AD-604 826 Div. 9, 21, 25
OTS Prices: HC $3.00/MF $0.75

Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
CONVECTIVE HEAT TRANSFER IN THE ENTRANCE REGION BETWEEN PARALLEL PLATES.
Master's thesis,
by William M. Pearce, Jr. Jun 64, 114p
AFIT GAM/ME/64-13

Unclassified report

Descriptors: (*Heat transfer, Flat plate models), (*Flat plate models, Heat transfer), Laminar flow, Partial differential equations, Numerical analysis, Transformations (Mathematics), Thermodynamics, Velocity, Pressure, Distribution, Space nuclear propulsion, Nozzles.

The hydrodynamic and convective heat transfer characteristics of laminar flow in the entrance region between infinite flat plates are investigated. The equation governing the motion of the fluid, the Navier-Stokes equation, is written in terms of the stream function, using the von Mises transformation, and solved numerically on a digital computer. The velocity and pressure gradient distributions obtained compare favorably with existing results. The energy equation is solved in a similar manner for four different physical conditions: both walls at a uniform temperature, one wall at a uniform temperature and the other thermally insulated, both walls with a uniform heat flux, and one wall with a uniform heat flux and the other thermally insulated. The temperature profiles and Nusselt numbers are determined for each case, and the results presented in graphic and tabular form. (Author)

10. Fuels and Combustion

AD-604 426 Div. 10, 4, 31
OTS Prices: HC $0.75/MF $0.50

Naval Research Lab., Washington, D. C.
THE IGNITION AND COMBUSTION PROPERTIES OF ACTIVATED CARBON CONTAINING ADSORBED HYDROCARBONS.
Interim rept.,
by F. J. Woods and J. E. Johnson. 28 Jul 64, 32p
NRL 6090

Unclassified report

Descriptors: (*Submarines, Fire safety), (*Carbon, Flammability), (*Hydrocarbons, Combustion), Air, Purification, Ventilation, Filters (Fluid), Impurities, Vapors, Adsorption, Oxidation, Ignition, Carbon dioxide, Carbon compounds, Monoxides.

Activated carbon contained in large filter beds is used in nuclear submarines for removal of odors and trace contaminants. Because organic vapors are concentrated in this way in the carbon, a study was made to get information for assessing the fire hazards involved in maintaining the carbon filter in the ventilation system of the submarines. In this study, spontaneous ignition of submarine-exposed carbons occurred at temperatures as low as 490F in air at one atmosphere. Exothermic oxidative reactions occurred in a flow system at temperatures as low as 390F. Combustion of carbons containing hydrocarbon produced considerable quantities of carbon dioxide and carbon monoxide, and significant amounts of these gases were evolved even under precombustion conditions. Of a number of carbons which had been used in submarines, the lowest flash point found was 160F. (Author)

AD-604 429 Div. 10, 9, 27
OTS Prices: HC $4.00/MF $0.75

General Applied Science Labs., Inc., Westbury, N. Y.
AN EXPERIMENTAL AND ANALYTICAL INVESTIGATION OF IGNITION AND AXI-SYMMETRIC TURBULENT FLAME PROPAGATION IN HYDROGEN-AIR MIXTURES AT SUPERSONIC SPEEDS,
by J. Tamagno and N. Trentacoste. Jul 64, 104p
GASL-TR-445
Contract AF49 638 991
AFOSR 64 1472

Unclassified report

Descriptors: (*Ramjet engines, Flame propagation), (*Flame propagation, Turbulence), (*Supersonic flow, Combustion), Reaction kinetics, Diffusion, Hydrogen, Alkenes, Air, Ignition, Thermodynamics, Jet flames, Axially symmetric flow, Photographic analysis, Fuel systems.

The report is concerned with the experimental study of turbulent combustion processes in high speed flows and the comparison of the experimental results with those obtained by means of a newly available numerical approach for the computation of flows with diffusion and finite rate chemistry. It is shown that stable ignition may be insured in a jet of hydrogen-air or ethylene-air mixture by a pilot flame of small dimensions and very low heat liberation compared to that of the main stream (of the order of 0.4%). Under proper conditions the premixed jet is ignited without fluctuations, periodic flashes or oscillations. A strong dependence of the flame propagation velocity on the mixture composition has been found experimentally for given constant flow conditions, i.e., flow velocity and total temperature of the mixture. This dependence correlated well with the predictions of the numerical computations. (Author)

AD-604 441 Div. 10, 4, 9, 27
OTS Prices: HC $5.00/MF $1.00

General Applied Science Labs., Inc., Westbury, N. Y.
REVIEW OF PROBLEMS IN APPLICATION OF SUPERSONIC COMBUSTION,
by Antonio Ferri. 14 May 64, 186p
Contracts AF49 638 991, AF33 657 10463
AFOSR 64 1471

Unclassified report

Paper presented at the Lanchester Memorial Lecture (7th), Royal Aeronautical Society, London, England, 14 May 64.

Descriptors: (*Ramjet engines, Combustion), (*Aerodynamic heating, Combustion), (*Supersonic flow, Combustion), Hypersonic flight, Propulsion, Performance (Engineering), Fuels, Jet flames, Control, Diffusion, Heat transfer, Jet mixing flow, Reaction kinetics, Chemical equilibrium, Reviews.

Topics include: possible air-breathing engine schemes; comparison of subsonic and supersonic combustion ramjets; possible performance of supersonic burning ramjets; aerodynamic heating; qualitative description of supersonic combustion controlled by mixing; analysis of reaction processes; analysis of mixing flows including mixing of non-reacting flows, with pressure gradients, and with combustion.

AD-604 475 Div. 10, 20, 22
OTS Prices: HC $2.00/MF $0.50

Radiation Applications, Inc., Long Island, N. Y.
RADIATION-INDUCED SOLID PROPELLANT DECOMPOSITION.
Technical rept. for 1 Dec 62-30 Nov 63,
by George Odian, Terese Acker, Thomas Pletzke, Ernest Henley, and R. F. McAlevy, III. 15 Jan 64, 30p
RAI 331
Contract AF49 638 1125
AFOSR 64 1448

Unclassified report

Descriptors: (*Solid rocket propellants, Radiation damage), (*Radiation damage, Solid rocket propellants), (*Ammonium compounds, Perchlorates), Radiation chemistry, Decomposition, Chemical reactions, Burning rate, Tensile properties, Ballistics, Deflagration, Solid rocket propellant binders, Solid rocket oxidizers.

An investigation was made of the effect of ionizing radiation on the burning rates and tensile strengths of various composite ammonium perchlorate propellants. The results of these studies demonstrated that, in many cases, drastic changes in burning rate and tensile strength occurred upon radiolysis. In order to elucidate the mechanism of these effects, a multi-pronged study of the effects of radiation on propellants and propellant components was initiated. This involved: (1) a study of the radiation induced decomposition of ammonium perchlorate with an elucidation of the various chemical species produced upon radiolysis and their yields (G values); (2) a study of radiation effects on burning rate by a technique in which the effect of radiation on each of the two components of a propellant, i. e., organic binder and inorganic oxidizer, is studied separately. (Author)

AD-604 556 Div. 10, 30
OTS Prices: HC $3.00/MF $0.75

Jet Propulsion Center, Purde Univ., Lafayette, Ind.
ANALYSIS OF A SERVO SYSTEM FOR CONTINUOUS MEASUREMENT OF THE BURNING RATE OF A SOLID PROPELLANT.

frames for hypersonic speeds (speeds faster than about March 5), Newtonian flow theory is examined from the point of view of gas dynamics and hypersonic small-disturbance theory. A general solution of the first approximation for the flow past slender bodies (bodies which cause only a small disturbance to the stream) at zero angle of attack is given. An important condition which limits the application of the theory is noted; namely, that the pressure coefficient on the surface not fall to zero. The theory is then applied to cones and to bodies whose shape is r = x to the nth power.

AD-605 083 Div. 9
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
HYPERSONIC, NON-VISCOUS FLOW AROUND A CIRCULAR DISK NORMAL TO THE STREAM,
by H. Serbin. 3 May 56, 28p P-930

Unclassified report

Legibility of this document is in part unsatisfactory. Reproduction will be made from the best available copy.

Descriptors: (*Hypersonic flow, Disks), Shock (Mechanics), Shock waves, Specific heat, Aerodynamic heating, Euations.

The report deals with the flow field around a blunt body of revolution immersed in a hypersonic, inviscid stream. The body considered is a disk mounted normal to the free stream. The principal assumption is that the ratio of specific heats in the flow behind the shock is near unity. The analysis is limited to first order terms in gamma-1. This is sufficient to derive the shock shape but not sufficient to locate the shoulder relative to the shock. It is intended to extend the theory to include second-order terms, thereby closing the gap in the theory. (Author)

AD-605 091 Div. 9
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A SIMPLE RELATION BETWEEN THE SHOCK AND EXPANSION PRESSURE COEFFICIENTS FOR TWO-DIMENSIONAL HYPERSONIC FLOW,
by J. L. Raymond and E. P. Williams. 15 Jan 57, 4p P-940

Unclassified report

Descriptors: (*Hypersonic flow, Two-dimensional flow), Hypersonic characteristics, Mathematical analysis, Shoc (Mechanics), Fluid dynamic properties, Pressure.

AD-605 104 Div. 9, 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
HYDRODYNAMICAL STABILITY AND POINCARE-LYAPUNOV THEORY-I,
by Richard Bellman and G. Milton Wing. 13 Oct 56, 10p P-960

Unclassified report

Prepared in cooperation with Los Alamos Scientific Lab., N. Mex.

Descriptors: (*Hydrodynamics, Stability), Partial differential equations, Nonlinear differential equations, Theory.

The purpose of the paper is to initiate a rigorous theory of hydrodynamical stability. Results were established corresponding to the classical Poincare-Lyapunov theory for systems of nonlinear ordinary differential equations, for classes of nonlinear partial differential equations occurring in hydrodynamics. (Author)

12. Guided Missiles

AD-604 415 Div. 12, 4, 16
OTS Prices: HC $5.00/MF $1.00

Aerospace Corp., Los Angeles, Calif.
THE EVALUATION AND APPLICATION OF CHEMICALLY REGENERATIVE ATMOSPHERIC CONTROL SYSTEMS,
by John W. Smylie. 1 Jun 64, 175p
TDR-269(4560-50)-2
Contract AF04 695 269
SSD TDR64 95

Unclassified report

Descriptors: (*Controlled atmospheres, Oxygen equipment), (*Oxygen equipment, Spacecraft), (*Carbon dioxide, Reduction (Chemistry)), Hydrogen, Water, Electrolysis, Methane, Lithium compounds, Oxides, Hydrides, Sodium, Pyrolysis, Radiation chemistry, Plants (Botany), Algae, Bacteria, Photosynthesis, Control systems, Closed ecological systems, Life support.

A survey and analysis is presented of carbon dioxide reduction, atmospheric regeneration systems. Emphasis was placed on inorganic chemical systems on the basis of availability, weight and power requirements, and compatibility with space vehicle design. The two most promising systems, methanization and carbonization (both utilizing hydrogen reduction of carbon dioxide into water and subsequent electrolysis of the water), were analyzed in detail and compared with other inorganic regeneration, biological, and open cycle systems. Both systems were evaluated with major emphasis given to the interaction between the complete vehicle design and the carbon dioxide removal and oxygen supply systems. A set of penalty curves were derived showing the effects on take-off weight of changes in the power penalty, leakage rate, water recovery system efficiency, and use of by-products from the carbon dioxide regeneration system. (Author)

AD-604 416 Div. 12, 30
OTS Prices: HC $3.00/MF $0.50

Space Sciences Lab., General Electric Co., Philadelphia, Pa.
PARAMETERS, TECHNIQUES, AND SIGNIFICANCE OF SOLAR SIMULATION IN SPACE SIMULATION TEST CHAMBERS.
Technical information series,
by Donald E. Lee and Leo Steg. Aug 64, 56p R64SD58

Unclassified report

Paper presented at the Fluid Dynamics Panel Meeting, Advisory Group for Aeronautical Research and Development, NATO, Marseilles, France, April 20-24, 1964.

Descriptors: (*Solar radiation, Test facilities), (*Sun, Simulation), (*Simulators, Solar radiation), Solar systems, Collimators, Test equipment, Design, Construction, Spaceflight, Space environmental conditions, Solar spectrum, Satellites (Artificial), Xenon lamps, Reflectors, Intensity, Equations.

A review of the significance of solar simulation (collimation, spectrum, etc.) on a typical satellite is given. Parameter affecting construction and performance of the solar simulation system and its relationship to a large space chamber are presented. Performance data of the complete chamber and sun system and early test results of typical satellite systems are reviewed. (Author)

AD-604 454 Div. 12, 18, 26, 30
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A GAME THEORETIC APPROACH TO SPACE VEHICLE PRELAUNCH ACTIVITIES SCHEDULING,
by Sidney I. Firstman. Jan 62, 28p P-2538

Unclassified report

Descriptors: (*Game theory, Launching), (*Scheduling, Launch vehicles (Aerospace)), Mathematical models, Probability, Monte Carlo method, Computers, Checkout procedures.

Two plausible objectives for the sequence of prelaunch activities for a space vehicle are (1) to maximize the probability that the countdown is successful in the sense that it terminates either with a vehicle that is launch ready or else the countdown is wisely aborted, and (2) to maximize the probability that each countdown culminates in a successful launch. These two objectives, while superficially similar, do not, in general, result in the same preferred sequences. This paper, which proves the foregoing assertion, uses the second objective in exploring the application of Game Theory to the problem of developing a preferred sequence.

AD-604 500 Div. 12, 8, 30
OTS Prices: HC $3.00/MF $0.75

Control and Information Systems Lab., Purdue Univ., Lafayette, Ind.
PRESENT STATE OF THE ART IN THE SPECIFICATION OF NONLINEAR CONTROL SYSTEMS.
Interim rept. no. 2 (rept. no. 5, final),
by J. E. Gibson, E. S. McVey, C. D. Leedham, Z. V. Rekasius, and D. G. Schultz. May 61, 92p
EE-61-6
Contract AF29 600 1933

Unclassified report

Descriptors: (*Nonlinear systems, Control systems), (*Control systems, Nonlinear systems), Reviews, Automatic, Computers, Systems engineering, Linear systems, Stability, Feedback, Differential equations, Mathematical models, Matrix algebra, Dynamic programming, Electrical engineering, Guidance.

This report is concerned primarily with assessing the state of the art of nonlinear control as a prelude to the solution of the actual specification problem. As an introduction, the classical methods of nonlinear analysis are discussed, and the reasons for the inadequacy of these techniques for automatic control systems are explained. The two generally known methods of analyzing the stability of autonomous nonlinear control systems, namely phase plane analysis and the describing function, are discussed. The concept of the state variable and the state space is introduced in some detail. The stability of the nonautonomous system and the response of autonomous and nonautonomous systems are covered. As a criterion for specification, the time optimum system is stressed, and distinction is made between the solution of the time optimum problem as a performance index and the synthesis of the optimum switching boundaries. The phase plane is discussed for forced systems and the work of Wiener is mentioned in connection with the response of nonlinear systems to random inputs.

AD-604 515 Div. 12, 21, 27
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
PROBLEMS OF INTERPLANETARY FLIGHTS,

Interim rept.
by J. R. Osborn and R. F. Panella. May 64, 84p
JPC-374, JPC-I-64-4
Grant AF AFOSR 207 63
AFOSR 64 1480

Unclassified report

Descriptors: (*Solid rocket propellants, Burning rate), (*Servomechanisms, Solid rocket propellants), Test equipment, Stability, Dynamics, Optimization, Functions, Labeled substances, Radiation measurement systems.

The project is concerned with the development of a servo system for the continuous measurement of the burning rate of a solid propellant under actual rocket motor conditions. By controlling the position of the burning surface of the solid propellant within the rocket motor, the burning rate can be measured. The object of this project was to determine the servo system dynamics. Stability, time response and optimization of the servo system were investigated. A theoretical analysis was made to determine component transfer functions. From the component transfer functions the overall system transfer function was derived. The Bode diagram was then used to determine system stability. The system transfer function was programmed on an analog computer, and the time response of the system was characterized. The servo system was built, and experimental results were obtained to verify the theoretical system transfer function. The system transfer function was optimized using two different criteria: optimum phase margin, and minimum ITAE. The system transfer function was again programmed on the analog computer, and the time responses for these two criteria were characterized. (Author)

11. Ground Transportation Equipment

No Entries

is considered as a means of reducing the necessary bi-elliptic velocity expenditure at the expense of transfer time. The bi-elliptic transfer is shown to be useful only in a limited band of orbital radii ratio values. This band decreases as the number of parking revolutions increases. The semi-tangential transfer (with and without parking) is considered as a means of further reducing the transfer time, often at the expense of an increase in velocity requirement. Each of the above transfer technique is then analyzed for velocity limited maneuvers. All three techniques are shown to possess features which recommend them as logical choices for certain types of missions. The logical extension of the Hohmann and bi-elliptic transfer modes are evolved for use in three-dimensional rendezvous missions. (Author)

AD-604 766 Div. 12
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
RED STAR SERIES ON GUIDED MISSILES. PT. I. CONSTRUCTION AND METHODS OF APPLICATION,
by V. Pugachev and B. Marisov. 1955,
10p T-44 pt. 1
TT 64 71260

Unclassified report

Trans. from Krasnaya Zvezda (USSR) 1955, 15 Feb, p. 3.

Descriptors: (*Guided missiles, Design), Guidance, Targets, USSR, Construction.

The article is an elementary exposition on the subject of guided missiles, their methods of guidance and methods of application. The article is illustrated by sketches of four missiles which superficially resemble three well-known USA guided missiles (the Matador, the Nike, and the Corporal) and one less well-known German missile (the X-4 air-to-air rocket). No mention is made of specific Soviet guided missile development.

AD-604 803 Div. 12
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
MAN'S ROLE IN SPACE,
by N. C. Dalkey. Nov 62, 12p P-2669

Unclassified report

Descriptors: (*Space flight, Manned spacecraft), Space probes, Costs, Space communication systems, Lunar probes, Language, Exploration, Sensory perception.

The reasons for sending human beings into space are discussed. Man's skills and innate capabilities are viewed as being superior to those of machines in exploration.

AD-604 809 Div. 12, 26
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
SPACE LOGISTICS: TECHNOLOGY VERSUS MANAGEMENT,
by Chauncey F. Bell. Aug 62, 10p P-2613

Unclassified report

Prepared for presentation at the IAS Large Booster Symposium, Sacramento, Calif., 29-30 Oct 62.

Descriptors: (*Logistics, Spacecraft), (*Management control systems, Logistics), Space maintenance, Scheduling, Costs, Design, Reliability, Maintainability.

The paper postulates that there are few new factors or elements in space logistics. Rather, the space environment places increased importance on improved management of these support elements, calling in some cases for use of automatic fault-isolation, test, checkout, and data-reduction techniques.

AD-604 8[illegible] Div. 12
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE SOVIET BALLISTIC MISSILE AND SPACE FLIGHT PROGRAM,
by F. J. Krieger. 2 Jun 58, 14p P-1388

Unclassified report

Descriptors: (*Space flight, Spacecraft), (*Guided missiles (Surface-to-surface), USSR), Rockets, Satellites (Artificial), Scientific research, History.

AD-604 858 Div. 12
OTS Prices: HC $4.00/MF $0.75

RAND Corp., Santa Monica, Calif.
THE APPLICATION OF DYNAMIC PROGRAMMING TO SATELLITE INTERCEPT AND RENDEZVOUS PROBLEMS,
by F. T. Smith. Aug 64, 108p RM-4241-PR
Contract AF49 638 700

Unclassified report

Descriptors: (*Intercept trajectories, Dynamic programming), (*Rendezvous trajectories, Dynamic programming), (*Terminal guidance, Satellites (Artificial)), Mathematical prediction, Partial differential equations, Matrix algebra, Differential equations, Linear systems, Statistical processes, Circular orbit trajectories, Flight control systems, Optimization.

This Memorandum discusses the application of dynamic programming to a terminal guidance process for satellite intercept and rendezvous problems. The mathematical equations describing the guidance process are derived and simplified by linearizing assumptions in order to reduce the complexity of the computation process. Some typical numerical data are then used to evaluate the effect of these linearizing assumptions on system performance. It is concluded that these linearizing assumptions result in satisfactory system performance within practical tolerances as far as the optimal control system is concerned. However, the linearizing assumptions appear to have an adverse effect on the performance of the filter used to process observational data. (Author)

AD-604 864 Div. 12, 6, 30
OTS Prices: HC $2.00/MF $0.50

Mitre Corp., Bedford, Mass.
A METHOD OF COMPUTING SATELLITE POSITION IN LOW-INCLINATION, LOW-ECCENTRICITY ORBITS AROUND AN OBLATE EARTH,
by R. H. Greene. Jul 64, 36p Mitre-TM-3500
Contract AF33 600 39852, Proj. 496L
ESD TDR63 443

Unclassified report

Descriptors: (*Satellites (Artificial), Position finding), (*Positon finding, Satellites (Artificial)), (*Orbital trajectories, Tracking), Differential equations, Polynomials, Geometry, Digital computers, Programming (Computers), Circular orbit trajectories, Spheres.

This document presents a method for computing the position of a satellite in a low-inclination, low-eccen-

by K. Stanyukovich. 15 Nov 54, 10p T-38
TT 64 71244

Unclassified report

Problemy Mezhplanetnykh Pereletov; Trans. from Krasnaya Zvezda (USSR) 1954, 10 Aug, p. 3.

Descriptors: (*Space flights, USSR), Rocket motors, Nuclear propulsion, Rocket motors (Liquid propellant), Thrust, Interplanetary trajectories, Rocket motor nozzles, Space craft, Space environmental conditions, Staging, Space stations, Liquid rocket propellants.

Great are the achievements of modern science and technology. Science, said President of the Academy of Sciences in U.S.S.R., A. N. Nesmeyanov, at the session of the World Peace Council on 27 November 1953, has reached such a state wherein the dispatch of a stratoplane to the Moon and the creation of an artificial satellite of the Earth are a reality. Our Soviet scientists and designers, who are devoting all their strength and knowledge to the cause of the further progress and prosperity of our Motherland, have made an enormous contribution to the solution of the very important problems of interplanetary flights.

AD-604 625 Div. 12, 9, 25
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ELASTIC STRESS WAVES PRODUCED BY PRESSURE LOADS ON A SPHERICAL SHELL,
by J. H. Huth and J. D. Cole. 30 Sep 54, rev. 16 Mar 55, 50p RM-1358, rev., P-614

Unclassified report

Descriptors: (*Guided missile components, Stresses), (*Elastic shells, Spheres), (*Mechanical waves, Aerodynamic loading), Shock waves, Pressure, Velocity, Steel.

The memorandum treats the problem of stresses in a spherical elastic shell subjected to a plane pressure wave traveling across it with constant speed, a case of technical interest when considering the effect of blast waves on the structure of a missile in flight. The analysis is subject to the following principal assumptions: (1) The effect of the sphere on the wave is neglected; (2) Momentless thin shell theory is assumed to apply. (Author)

AD-604 667 Div. 12
OTS Prices: HC $1.00/MF $0.50

Air Force Cambridge Research Labs., Bedford, Mass.
REMARKS ON THE DECAY OF 1958 ZETA,
by W. A. Delaney. May 59, 13p
AFCRL TN59 454; AFCRL GRDST5

Unclassified report

Rept. on Proj. Space Track.

Descriptors: (*Satellites (Artificial), Orbital trajectories), Degradation, Life expectancy, Communication satellites (Active).

The decay of 1958 Zeta is discussed briefly. Its last observed revolution and the decrease in its period are presented graphically. The last three sighting reports are given. (Author)

AD-604 668 Div. 12
OTS Prices: HC $1.00/MF $0.50

Air Force Cambridge Research Labs., Bedford, Mass.
EMPIRICAL PARAMETERS DETERMINING THE LIFETIME OF ARTIFICIAL EARTH SATELLITES,
by H. B. Wackernagel. May 59, 18p
AFCRL TN59 455; AFCRL GRDST6

Unclassified report

Rept. on Proj. Space Track.

Descriptors: (*Satellites (Artificial), Life expectancy), Mathematical prediction, Orbital trajectories, Equations.

The decay of the orbit of most artificial earth satellites can be described by the simple formula log N = R (log delta P sub N + Q) N is the revolution number reckoned backwards from the revolution of decay and delta P sub N a quantity defined in the text. The parameters R and Q are correlated to the ratio m/F of mass and effective cross section and to the height of the perigee q, respectively. (Author)

AD-604 689 Div. 12, 6, 25
OTS Prices: HC $8.15/MF $2.25

Perkin-Elmer Corp., Norwalk, Conn.
STUDY AND EXPERIMENTAL PROGRAM OPDAR TRAJECTORY MEASUREMENT SYSTEM.
Final rept.,
by B. Krauss, J. McNeill, R. McFarlane, H. R. Freeman, and R. Rowley. Jul 64, 513p PE-7534B
Contract AF30 602 3189, Proj. 5930, Task 593006
RADC TDR64 169

Unclassified report

Descriptors: (*Guided missile tracking systems, Lasers), (*Lasers, Guided missile tracking systems), Guided missile trajectories, Measurement, Optical equipment, Radar tracking, Models (Simulations), Feasibility studies.

A CW optical radar (OPDAR) for precise early launch phase trajectory measurement is described. A single instrument measures slant range, azimuth and elevation to a small, passive retroreflector mounted on the missile. The data collected is suitable for real-time trajectory evaluation and for post flight computer processing to yield highly precise position, velocity, and acceleration information. Laboratory models of critical components were constructed to demonstrate system feasibility. Models included a shaft angle encoder, a retroreflector, and a model of the range measurement system. An experiment was conducted to measure the effects of laser noise. (Author)

AD-604 751 Div. 12, 15
OTS Prices: HC $4.00/MF $1.00

Aerospace Corp., Los Angeles, Calif.
STUDIES RELATIVE TO RENDEZVOUS BETWEEN CIRCULAR ORBITS,
by B. H. Billik and H. L. Roth. 22 Jun 64, 137p
TDR-269(4550-10)-7
Contract AF04 695 269
SSD TDR64 41

Unclassified report

Descriptors: (*Rendezvous trajectories, Optimization), (*Transfer trajectories, Optimization), (*Orbital trajectories, Rendezvous trajectories), Parking orbit trajectories, Astronautics, Mathematical analysis, Numerical methods and procedures.

In-plane rendezvous from an inner circular parking orbit to an outer circular target orbit is studied. Comparisons are made between the Hohmann and the bi-elliptic transfer techniques. Parking in either bi-elliptic transfer ellipse

13. Installations and Construction

AD-604 375 Div. 13, 23
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE CIVIL ENGINEERING CHALLENGE. AN OUTSIDER'S VIEW OF AIR FORCE CIVIL ENGINEERING,
by H. L. Brode. 24 May 61, 22p P-2323
Unclassified report

Paper delivered to the Advanced Weapon Systems and Facilities Symposium, May 22-25, 1961 at the Air Univ., Institute of Technology, Civil Engineering Center.

Descriptors: (*Civil engineering, Air force), (*Construction, Military engineering), (*Military personnel, Civil engineering).

A set of admonitions is aimed at those military officers responsible for the construction and maintenance of structures in support of weapon systems. The need for early attention to the new and special construction requirements of developing systems is illustrated. The consequences of lack of attention to detail and the exacting demands that are placed on the expert in uniform for supervision of design and conduct of research are emphasized. Some special problems in this area of military engineering are identified and some suggestions for improvement are alluded to. Successful military engineering relies heavily on competent civil engineering, so that much of the admonishments here are equally appropriately directed to those civilian engineers, both commercial and academic, engaged in these same military programs. (Author)

AD-604 718 Div. 13, 32
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
CRITERIA FOR THE SELECTION OF WATER-RESOURCE PROJECTS,
by Roland N. McKean. 16 Sep 55, 16p P-689-RC
Unclassified report

Descriptors: (*Water supplies, Systems engineering), Floods, Control systems, Operations research, Damage, Irrigation systems, Costs, United States Government.

The problem of selecting water-resource developments such as navigation, flood-control, and soil-conservation measures is discussed. The use of analysis to increase efficiency in water-resource development is suggested.

AD-604 739 Div. 13, 12
OTS Prices: HC $7.00/MF $1.50

Malaker Labs., Inc., High Bridge, N. J.
INVESTIGATION OF GAS LIQUEFIERS FOR SPACE OPERATION.
Rept. for Oct 62-May 63,
by J. G. Daunt, R. A. Rossi, E. G. Jakobsson, and S. F. Malaker. Aug 63, 321p
Contract AF33 657 10133, Proj. 8169, Task 816903
ASD TDR63 775
Unclassified report

Descriptors: (*Liquefied gases, Preparation), (*Spacecraft, Liquefied gases), Refrigeration systems, Helium, Hydrogen, Nitrogen, Fluorine, Oxygen, Thermodynamic cycles, Joule-Thompson Effect, Stirling cycle, Refrigerant compressors, Space environmental conditions, Compatibility, Weight, Volume, Reliability, Reviews.

A detailed description and comparison is given of thermodynamic cycles suitable for use in space for the liquefaction and reliquefaction of He, H2, N2, F2 and O2 at rates from 1 lb/ day to 1000 lbs/day. A survey is presented of the mode of operation, performance and efficiency of the following cycles: cascaded compressed vapor cycles, systems using Joule-Thomson cooling only, system using expansion engines, Stirling cycle systems, Taconis cycle systems and miscellaneous systems. Tables and graphs are included presenting the significant data on performance of each suitable cycle based on conservative estimates of the current state-of-the-art and on optimistic estimates of the probable future state for the period 1965-1970. A survey is given of space environment and detailed discussions are presented on the question of component compatibility and design for space operation, particularly covering such matters as component weights, volumes and reliability. (Author)

tricity orbit around an oblate earth using a set of orbital elements developed by S. Herrick. Previous investigations using these orbital elements have not included the perturbations caused by the oblateness of the earth. The entire procedure has been programmed for a digital computer, and the results checked with other methods which make use of different orbital parameters. A relatively small amount of computer time is required. (Author)

AD-604 865 Div. 12, 27, 30
OTS Prices: HC $3.00/MF $0.75

Mitre Corp., Bedford, Mass.
ENGINEERING SIMULATION OF POWERED FLIGHT,
by R. W. Dix. Jul 64, 64p Mitre-W-06871
Contract AF19 628 2390, Proj. 611 1
ESD TDR64 112

Unclassified report

Descriptors: (*Flight simulators, Space flight), (*Programming (Computers), Flight simulators), Guided missile simulators, Space propulsion, Special purpose computers, Compilers.

This document describes the current effort toward establishing a workable engineering simulation of the space-ground environment applicable to a wide variety of missile and space systems. Two powered flight computer programs have evolved from this effort. This report describes the content, inputs and outputs of each of these programs. (Author)

AD-604 885 Div. 12, 19
OTS Prices: HC $4.00/MF $0.75

RAND Corp., Santa Monica, Calif.
THE APPLICATION OF DYNAMIC PROGRAMMING TO ORBIT TRANSFER PROCESSES,
by F. T. Smith. Aug 64, 120p P-2957

Unclassified report

Descriptors: (*Transfer trajectories, Dynamic programming), (*Dynamic programming, Transfer trajectories), (*Orbital trajectories, Mathematical programming), Space flight, Nonlinear differential equations, Optimization, Celestial mechanics, Rendezvous guidance, Numerical analysis, Partial differential equations, Adaptive control systems, Guidance, Space navigation.

Dynamic programming is described as the mathematical theory of multistage decision processes and orbit transfer processes are considered multistage decision processes. The state variables of an orbit transfer process at any instant of time can be represented by the vehicle's position and velocity components or some related set of parameters. The decision at any instant of time can be represented by the rocket thrust vector or the vehicle acceleration vector that it produces. Dynamic programming is shown to provide a method of choosing the decision vector so that the state variables follow as closely as possible some prescribed behavior.

AD-605 062 Div. 12, 1
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE RESPONSE OF A BISYMMETRIC AIRCRAFT TO SMALL COMBINED PITCH, YAW, AND ROLL CONTROL ACTIONS.
An abridged Doctoral thesis,
by Robert A. Davis. 10 Sep 56, rev. 27 Dec 56, 34p P-898

Unclassified report

Descriptors: (*Guided missiles, Motion), Roll, Pitch (Motion), Yaw, Downwash, Stability, Angle of attack, Flight control systems.

The linearized equations of motion of a rolling bisymmetric aircraft are formulated using body axes. It is shown that (a) the rate of change of angle of attack is a vector; (b) a linearized form of the downwash-lag terms is valid only if the downwash-roll angle be small; and (c) such a linearized form must use the vector relations of (a). As a result, stability criteria are derived which are independent of the rolling of the reference axis system. The complete solution to the equations is presented for a stepped pitch/yaw control action at constant roll rate. The complete solution is likewise given for a variable roll rate, valid only for a simplified system in which the Magnus Effect is neglected. (Author)

DEVELOPMENT OF NONFLAMMABLE HYDRAULIC FLUIDS AND LUBRICANTS.
Bimonthly progress rept. no. 5, 18 Jun-17 Aug 64,
by E. H. Kober, H. F. Lederle, and G. F. Ottmann.
28 Aug 64, 34p
Contract NObs90092
Unclassified report

AD-601 677.

Descriptors: (*Hydraulic fluids, Preparation), (*Lubricants, Preparation), (*Organic phosphorus compounds, Synthesis (Chemistry)), (*Organic nitrogen compounds, Synthesis (Chemistry)), Solubility, Substitution reactions, Chlorine compounds, Fluorine compounds, Wear resistance, Thermal properties, Stability.

A new type of water-soluble phosphonitrilate for potential use as water-base hydraulic fluid was synthesized by the reaction of trimeric bis (p-hydroxyphenyl) phosphonitrilate with ethylene oxide. Trimeric and tetrameric bis (p-nitrophenyl) phosphonitrilate, a trimeric bis (m-nitrophenyl-2, 2, 2-trifluoroethyl) phosphonitrilate, and tetrameric bis(p-hydroxyphenyl) phosphonitrilate were synthesized as intermediates to be used in the preparation of potential water-base hydraulic fluids. Hexakis (3-pyridinyl) triphosphonitrilate was synthesized and found to be water insoluble. The chloromethylation of hexaphenyl triphosphonitrilate was effected employing chloromethyl methyl ether as chloromethylating agent. Several new arylamino-polyfluoroalkoxy phosphonitriles were isolated and characterized. Two trimeric and two tetrameric mixed substituted aryl-polyfluoro alkyl phosphonitrilates performed very satisfactorily in Falex wear tests. (Author)

AD-604 549 Div. 14, 25
OTS Prices: HC $1.00/MF $0.50

Naval Ordnance Lab., White Oak, Md.
THERMODYNAMIC PROPERTIES OF NATURAL RUBBER AND ISOPRENE,
by R. W. Warfield and M. C. Petree. 18 Jun 64, 21p
NOL TR64 79
Unclassified report

Descriptors: (*Rubber, Thermodynamics), (*Isoprene, Thermodynamics), Polymers, Thermal properties, Specific heat, Entropy, Enthalpy, Polymerization, Transition temperature, Molecular properties.

Using published specific heat data, the entropy, enthalpy, and Gibbs free energy of natural rubber (NR) was calculated over the temperature range 0 to 320K. These functions were also calculated for isoprene over the temperature range 0 to 300K. At 298.16K the entropy of polymerization was found to be 24.00 cal/mole deg. and the free energy of polymerization 10.7 Kcal/mole. The thermodynamic function Cp/T versus T calculated for NB exhibits a maximum at 50K and another maximum at 210K which is associated with the glass transition. The number of classically vibrating units per repeating unit of NR is 6.61 at 300K. (Author)

AD-604 573 Div. 14, 31
OTS Prices: HC $1.00/MF $0.50

United States Rubber Co., Wayne, N. J.
PROTECTIVE COATINGS FOR DEEP SUBMERGENCE VESSELS.
Quarterly rept. no. 2, 18 May-18 Aug 64,
by D. C. MacDonald and A. S. Glowacki. 28 Aug 64
20p
Contract NObs90246, Proj. SR007 03 04, Task 1008
Unclassified report

See also AD-600 905.

Descriptors: (*Moistureproofing, Laminates), (*Underwater equipment, Protective coverings), (*Laminates, Mechanical properties), Pressure vessels, Coatings, Reinforcing materials, Glass textiles, Moisture, Penetration, Fibers, Loading (Mechanics), Stresses, Fracture (Mechanics), Plastic coatings, Water vapor, Diffusion, Ship structural components, Moistureproofing.

Stress cycling of resin/fiberglass laminates at fiber stresses ranging from 13,000 to 70,000 psi does not significantly alter the physical properties of the laminate. At high fiber stress levels, laminates developed cracks parallel to the surface filaments. These cracks were observed after 10,000 cycles at fiber stresses in excess of 50,000 psi. (Author)

AD-604 654 Div. 14, 12
OTS Prices: HC $1.00/MF $0.50

Air Force Materials Lab., Research and Technology Div., Wright-Patterson AFB, Ohio.
AIR FORCE MATERIALS LABORATORY SOLID FILM LUBRICATION RESEARCH,
by B. D. McConnell. Apr 64, 19p
Projs. 3044, 7342, Tasks 304404, 734204
ML TDR64 46
Unclassified report

Descriptors: (*Lubricants, Solids), (*Bearings, Lubrication), Aerospace craft, Weapon systems, Friction, Wear resistance, Vacuum, Heat transfer, Reentry vehicles, Graphite.

The report outlines the general range of bearing lubrication requirements of present aerospace vehicles as well as briefly describes the range of requirements anticipated for future Air Force weapon systems. Some of the Air Force Materials Laboratory sponsored programs designed to meet these requirements are discussed in detail. This report covers only those concerned with solid film lubrication and contains discussion of both development-type programs and related basic or fundamental-type programs. Program objectives approaches to the problems, data obtained to date, and future work are discussed for each program. (Author)

AD-604 682 Div. 14, 4
OTS Prices: HC $0.50/MF $0.50

Naval Research Lab., Washington, D. C.
SOME SURFACE CHEMICAL ASPECTS OF GLASS-RESIN COMPOSITES. PART 1. WETTING BEHAVIOR OF EPOXY RESINS ON GLASS FILAMENTS.
Technical rept. no. 1,
by Willard D. Bascom. 10 Aug 64, 25p
Proj. NR356 459
NRL 6140
Unclassified report

Descriptors: (*Filament wound construction, Surface properties), (*Epoxy plastics, Surface properties), (*Glass textiles, Surface properties), Composite materials, Filaments, Binders, Impregnation, Silanes, Halogenated hydrocarbons, Amines, Molecular structure, Coatings, Mechanical properties, Bubbles, Material forming.

A study was made of the wetting behavior of epoxy resins on glass filaments and its relation to the fabrication and the properties of filament wound glass-resin composites. The experiments were designed to determine how wetting is affected by the surface finish on the glass, the molecular structure of the epoxy liquid, and the presence in the liquid

14. Materials (Non-Metallic)

AD-604 330 Div. 14, 25, 30
OTS Prices: HC $1.00/MF $0.50

Redstone Scientific Information Center, Redstone Arsenal, Ala.
A PRACTICAL METHOD FOR INVESTIGATING AND MEASURING THE BIREFRINGENCE OF OPTICAL GLASS,
by H. L. Tardy. 28 Jul 64, 15p
RSIC 236; TT 64 71233

Unclassified report

Trans. of Revue d'Optique Theorique et Instrumentale (France) 1929, v. 8, p. 59-69.

Descriptors: (*Optical glass, Optical properties), Heat treatment, Refractive index, Test methods, Light, Test equipment, Optical equipment, Measurement.

A practical method is presented for studying the annealing of optical glass. It is possible: 1. to survey at one glance the general distribution of the birefringence; 2. to determine quickly (in a few seconds) the value of the birefringence in arbitrarily selected points; 3. to trace, if this be deemed useful, the contour lines of the birefringence on the glass under examination. A suitable instrumental arrangement is described.

AD-604 418 Div. 14, 17
OTS Prices: HC $6.00/MF $1.25

Dayton Univ., Ohio. Research Inst.
THE EVALUATION OF HIGH TEMPERATURE MATERIALS SYSTEMS WITH AN ARC-PLASMA-JET.
Rept. for Feb 61-Jan 62,
by Howard E. Smith and John C. Wurst. Jun 64, 257p
Contract AF33 616 7838, Proj. 7381, Task 738103
ML TDR64 73

Unclassified report

Descriptors: (*Refractory metal alloys, Coatings), (*Coatings, Heat-resistant metals and alloys), (*Heat resistant materials, Performance (Engineering), Refractory materials, Mechanical properties, Plasma jets, Refractory coatings, Ablation, Composite materials, Failure (Mechanics), Sprays, Ceramic coatings, Oxidation, Test methods, Test equipment, Environmental tests Experimental data, Materials, Protective treatments, Laminated plastics, Molding materials, Cermets.

A small arc-plasma-jet was suitably modified and utilized for the evaluation and screening of high temperature materials at heat flux levels ranging from 10 to 500 Btu/sq. ft-sec. A 'standard' evaluation procedure was employed to characterize a number of systems representing ablating, insulating, and heat sink type materials. Results of these tests are presented in terms of weight loss, density change, depth and volume of erosion, and front and back surface temperatures. A metallographic analysis of coating failures in the XLR-99 thrust chamber of the X-15 research aircraft and the subsequent development of a thermal shock test with the plasma-jet for sprayed ceramic coatings are discussed. The results of an extensive evaluation of protective coatings and the field test verification of these results are presented. Preliminary tests leading to the development of a dynamic oxidation test are discussed and the results of arc-plasma-jet tests of five silicide coatings on Mo-1/2% Ti are presented. (Author)

AD-604 423 Div. 14, 12
OTS Prices: HC $5.00/MF $1.00

Marquardt Corp., Van Nuys, Calif.
APPLICATION AND EVALUATION OF REINFORCED REFRACTORY CERAMIC COATINGS.
Rept. for Apr 61-Apr 62,
by Charles Kallup, Jr., Samuel Sklarew, and Stanley V. Castner. Jun 64, 173p
Contract AF33 616 8209, Proj. 7381, Task 738101
ML TDR64 81

Unclassified report

Descriptors: (*Refractory coatings, Reinforcing materials), (*Ceramic coatings, Reinforcing materials), Heat resistant metals and alloys, Tantalum, Molybdenum alloys, Titanium alloys, Stainless steel, Zirconium compounds, High-temperature research, Nose cones, Protective treatments, Casting, Welding, Impact shock, Rupture, Mechanical properties, Thermal properties, Alloys, Metals, Refractory metals, Aerodynamic configurations, Oxidation.

Metal reinforced refractory ceramic coating systems have been developed to successfully withstand temperatures in excess of 4000F while providing insulative values for the supporting substructure. Eighty coating compositions were formulated and thermally evaluated in the plus 4000F range. Refractory coating of model nose cones and leading edges has been accomplished by utilizing a vibratory casting technique and the feasibility of this approach has been demonstrated. Twelve small scale leading edge models and six small scale nose cone models were coated in addition to one 500 square inch leading edge and one 500 square inch nose cone model. Thicknesses ranged from 0.3 to 0.75 inch. Mechanical data and thermophysical properties of an advanced coating system were obtained. An up-to-date bibliography of reinforced refractory ceramic systems and allied subjects is included. (Author)

AD-604 463 Div. 14, 12, 17
OTS Prices: HC $3.00/MF $0.75

Union Carbide Corp., Parma, Ohio.
HIGH TEMPERATURE PROTECTIVE COATINGS FOR GRAPHITE.
Special summary rept.,
by J. M. Criscione, R. A. Mercuri, E. P. Schram, A. W. Smith, and H. F. Volk. Jun 64, 89p
Contract AF33 657 11253, Proj. 7350, Task 735002
ML TDR64 173 P1

Unclassified report

Descriptors: (*Graphite, Refractory coatings), (*Refractory coatings, Graphite), (*Coatings, Graphite), Protective treatments, Oxidation, High-temperature research, Plating, Diffusion, Ceramic coatings, Vapor plating, Electrodeposition, Physical properties, Cermets, Sprays, Coatings, Metals, Oxides, Carbides, Borides, Silicides, Refractory materials, Transition temperature, Spacecraft, Guided missiles, Oxygen, Carbon.

A review of previous work on protective coatings for graphite, a description of several basic factors controlling the oxidation protection of graphite, and a review of existing information on the diffusion of oxygen and carbon through coating materials, the volatility, the chemical stability, and the mechanical compatibility of coating materials is presented. It is concluded that a considerable amount of research is needed to evaluate coating materials for the protection of graphite from oxidation at temperatures of 2000C and higher. (Author)

AD-604 490 Div. 14, 4
OTS Prices: HC $2.00/MF $0.50

Olin Mathieson Chemical Corp., New Haven, Conn.

AD-605 096 Div. 14, 25
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
POISSON'S RATIO FOR HONEYCOMB SANDWICH CORES,
by George A. Hoffman. 23 Apr 57, 34p P-946
Unclassified report

Descriptors: (*Honeycomb cores, Mechanical properties), (*Sandwich panels, Honeycomb cores), Sandwich construction, Loading (Mechanics), Deformation, Elasticity, Plasticity, Stresses.

An interesting property of honeycomb cores is that their apparent Poisson's ratio may assume values from almost zero to well above one, depending upon the shape and orientation of the cells. This unusual behavior prompted this study, wherein Poisson's ratio is derived for cores with hexagonal and square cells. The ratio is then related to the stiffness of a sandwich panel containing such cores. It is shown that large variations of Posson's ratio for honeycomb cores have little effect on the stiffness of the sandwich panel. (Author)

of a curing agent. Wetting behavior on freshly drawn E-glass fibers was compared with the wetting of commercial HTS-finished E-glass filaments and of glass fibers coated with hydrolyzed silane finishing agents. It was found that the HTS and the silane finished glass were poorly wet by all the epoxy liquids regardless of the chemical structure of the liquid or the presence of amine. The dynamic advancing contact angle formed against a fiber as it moves into the liquid was generally about 10 to 20 degrees higher than the static, equilibrium advancing angle. The HTS and silane finished glass fibers were covered with a visible coating of the sizing material. The coating materials were only partially soluble in the epoxy liquids. Observations of filament winding on pilot plant equipment, as well as the examination of segments of impregnated glass roving taken from the machine, revealed that air bubbles amounting to a significant portion of the total volume were entrapped in the glass-resin composite. For optimum impregnation it is necessary that the resin wet the glass fiber at a zero contact angle and mechanical means must be provided in the winding operation of minimize air entrainment and to release air bubbles from the roving.

AD-604 683 Div. 14
OTS Prices: HC $4.00/MF $0.75

Carbon Products Div., Union Carbide Corp., Lawrenceburg, Tenn.
RESEARCH AND DEVELOPMENT ON ADVANCED GRAPHITE MATERIALS. VOLUME XXXIII. INVESTIGATION OF HOT-WORKED RECRYSTALLIZED GRAPHITES.
Rept. for May 61-Jan 63,
by J. H. Turner and M. B. Carter. Jun 64, 104p
Contract AF33 616 6915, Projs. 7350, 7381, Tasks 735002, 738102
WADD TR61 72 V33

Unclassified report

Descriptors: (*Graphite, Refractory materials), (*Refractory materials, Graphite), (*Hot working, Graphite), Physical properties, Mechanical properties, Porosity, Density, Tensile properties, Compressive properties, Elasticity, Thermal expansion, Thermal conductivity, Permeability, Erosion, Admittance, Hardness, Powders, Extrusion, Binders, Carbon, Sulfur, Composite materials, High temperature research, Microstructure, Oxidation, Plastics, Crystal structure, Anistropy, Manufacturing methods.

Fabrication and testing of hot-pressed (ZT) graphites made from several base stocks are discussed. Physical properties, with emphasis on porosimetry, are reported for varieties of molded and pressure-cured graphites both before and after hot pressing. A small amount of work was also done with hot pressing of extruded graphites, powders, composites, and the surfaces of formed articles. The latter process is termed surface densification. (Author)

AD-604 685 Div. 14, 12, 17, 26
OTS Prices: HC $5.00/MF $1.00

Boeing Co., Seattle, Wash.
METAL-CERAMIC STRUCTURAL COMPOSITE MATERIALS.
Rept. for 1 Feb 61-Feb 62,
by J. W. Vogan and J. L. Trumbull. Jun 64, 185p
Contract AF33 616 7815, Proj. 7381, Task 738102
ML TDR64 83

Unclassified report

Descriptors: (*Ceramic materials, Composite materials), (*Composite materials, Honeycomb cores), (*Honeycomb cores, Reinforcing materials), (*Metals, Reinforcing materials), Reentry vehicles, Aerospace craft, Magnesium compounds, Thorium compounds, Zirconium compounds, Oxides, Foams, Refractory materials, Fiber metallurgy, Wires, Sintering, Laminates, Power metallurgy, Physical properties, Ablation, Flame spraying, Tests, Platinum, Nickel alloys, Chromium alloys, Iron alloys, Molybdenum alloys, Titanium alloys, Aluminum alloys.

Thoria and magnesia bodies were developed for use in metal-ceramic composites. Good thermal shock resistance was imparted to these bodies through control of particle size distribution. Magnesia was sintered at 2200F and thoria at 2800F. Plasma and oxyacetylene torch tests developed to evaluate these materials and similar zirconia composites showed that magnesia and zirconia can be used to 4600F and thoria to 5400F. A magnesia foam backing was developed for use with composites to reduce heat transfer to the substructure with a minimum gain in overall weight. Platinum and Inconel honeycomb were selected for use as a metal reinforcement for these bodies to produce material systems suitable for use in high heat flux applications such as the nose cap of a glide re-entry vehicle. Leading-edge configuration samples prepared from magnesia with Inconel honeycomb reinforcements were fabricated.

AD-604 754 Div. 14
OTS Prices: HC $1.00/MF $0.50

Aeronautical Materials Lab., Naval Air Engineering Center, Philadelphia, Pa.
THE EVALUATION OF SIX PAINT STRIPPING COMPOUNDS RECEIVED FROM NAVAL AIR STATION, ALAMEDA, CALIFORNIA,
by A. J. Koury. 11 Aug 64, 1p
NAEC-AML 2014

Unclassified report

Descriptors: (*Paint removers, Effectiveness), (*Aircraft finishes, Paint removers), Plastic coatings, Epoxy plastics, Tests.

One of six unnamed compounds is recommended for the removal of epoxy aircraft finishes.

AD-604 860 Div. 14
OTS Prices: HC $6.00/MF $1.25

Syracuse Univ., N. Y. Research Inst.
MATERIALS DESIGN HANDBOOK: DIVISION, I STRUCTURAL PLASTICS.
Rept. for Nov 60-Feb 63,
by C. S. Grove, Jr. and R. Ford Pray, III. May 64, 202p
Contract AF33 616 7736, Proj. 7381, Task 738103
ML TDR64 141

Unclassified report

Descriptors: (*Plastics, Handbooks), (*Structural parts, Plastics), Polyester plastics, Epoxy plastics, Phenolic plastics, Silicone plastics, Reinforcing materials, Physical properties, Design, Analysis, Manufacturing methods, Machining, Processing, Tests, Quality control, Instruction manuals.

The purpose of the report is to partially satisfy the need for a design handbook specifically tailored for structural plastic applications in aerospace vehicles. This first edition contains a preliminary collection of technical data and information on these materials. The format and organization was developed, based on consultation with a wide variety of industrial and government concerns, to be rapidly useable and concise. Information presented is categorized into seven Manuals discussing topics such as material properties, theoretical analysis, design procedures, processing and testing. (Author)

ANALYTICAL APPROXIMATIONS: VOLUME 16,
by Cecil Hastings, Jr. and James P. Wong, Jr.
25 Aug 54, 6p P-559
Unclassified report

Descriptors: (*Numerical analysis, Integrals), (*Integrals, Numerical analysis), Numerical methods and procedures, Statistical tests.

Analytical approximations of Chi-Square integrals are presented.

AD-604 396 Div. 15, 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
REVISIONS AND EXTENSIONS TO THE SIMPLEX METHOD (WITH SIDE-LIGHTS ON PROGRAMMING TECHNIQUES),
by William Orchard-Hays. 2 Sep 54, 23p P-562
Unclassified report

Descriptors: (*Linear programming, Programming (Computers)), Computers, Matrix algebra, Optimization, Corrections, Control sequences, Theorems.

Modification in various ways of the simplex algorithm for solving linear programming problems and its implications for flexibility and adaptability in a computer code is examined.

AD-604 398 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
CONSTRUCTIVE PROOF OF THE MIN-MAX THEOREM,
by George B. Dantzig. 8 Sep 54, 18p P-564
Unclassified report

Descriptors: (*Game theory, Theorems), Matrix algebra, Linear programming, Equations, Iterative methods.

A short algebraic proof of the fundamental theorem of games is given that is elementary and constructive. A simple example illustrates the method. (Author)

AD-604 399 Div. 15, 18, 32
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
DECISION MAKING IN THE FACE OF UNCERTAINTY: I (UNCERTAIN OUTCOME),
by Richard Bellman. 21 Sep 54, 8p P-568
Unclassified report

Descriptors: (*Decision theory, Logistics), Decision making, Economics, Statistical functions, Stochastic processes, Mathematical models.

A number of simple multi-stage decision processes where the intuitive concept of maximizing expected gain over expected cost is valid are considered. (Author)

AD-604 404 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
DYNAMIC PROGRAMMING AND A NEW FORMALISM IN THE THEORY OF INTEGRAL EQUATIONS,
by Richard Bellman. 1 Oct 54, 8p P-574
Unclassified report

Descriptors: (*Dynamic programming, Integral equations), (*Integral equations, Dynamic programming), Differential equations, Functions.

It is shown that the functional equation technique of the theory of dynamic programming may be used to derive functional differential equations for the characteristic values of a certain integral equation similar to those obtained for the eigenvalues of differential equations. (Author)

AD-604 405 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ON A QUASI-LINEAR EQUATION,
by Richard Bellman. 1 Oct 54, 11p P-575
Unclassified report

Descriptors: (*Equations, Dynamic programming), (*Dynamic programming, Equations), Statistical analysis, Numerical methods and procedures, Theorems.

The purpose of this paper is to establish some limit theorems for the solutions of non-linear recurrence relations. Recurrence relations of this kind occur in various dynamic programming problems. (Author)

AD-604 406 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ON AN ITERATIVE PROCEDURE FOR OBTAINING THE PERRON ROOT OF A POSITIVE MATRIX,
by Richard Bellman. 5 Oct 54, 12p P-577
Unclassified report

Descriptors: (*Iterative methods, Matrix algebra), (*Matrix algebra, Iterative methods), Game theory, Dynamic programming, Numerical methods and procedures.

An iterative procedure for obtaining the characteristic root of largest absolute value of a positive matrix, the Perron Root, is derived which yields geometric convergence. (Author)

AD-604 439 Div. 15
OTS Prices: HC $1.00/MF $0.50

Stanford Univ., Calif.
AN OBSTACLE-COURSE PROBLEM: I.
Technical rept. no. 98,
by Joseph Kadane. 30 Jul 64, 17p
Contract Nonr225 52, Proj. NR342 022
Unclassified report

Descriptors: (*Probability, Statistical analysis), (*Optimization, Probability), Decision theory, Algebra, Analysis of variance, Theorems, Convex sets.

An obstacle course is presented in which n obstacles are given, together with the probability of successfully overcoming the i(th) obstacle. A runner is permitted to choose r < or = n (r fixed) obstacles and to order them, so that he maximizes his expected value, on the assumption that once he fails to overcome an obstacle he receives only the points previously earned. The optimal ordering of the chosen r is a simple function of the obstacle parameters. The optimal choice of which r to attempt is more complicated, and three alternative computational procedures are

15. Mathematics

AD-604 363 Div. 15
OTS Prices: HC $4.00/MF $1.00

RAND Corp., Santa Monica, Calif.
STATISTICS ON THE FIRST SIX MILLION PRIME NUMBERS,
by F. Gruenberger and G. Armerding. Oct 61, 150p P-2460
Unclassified report

Descriptors: (*Prime numbers, Statistical analysis), (*Statistical analysis, Prime numbers), Numbers, Numerical analysis, Distribution, Tables.

The first table shows the distribution of differences between successive primes, as well as the first occurrence of each difference. The second table exhibits every difference greater than 100 with the lower prime of the pair being printed. The third table shows, for every 50,000 natural numbers, the following information: (1) The number of primes in the indicated range; (2) The last prime to be found in the range; (3) The number of occurrences of triplets having the difference pattern 2,4; (4) The number of occurrences of triplets having the difference pattern 4,2; (5) The number of occurrences of quartets having the difference pattern 2,4,2. The fourth table displays explicitly the lowest prime of each four having a 2,4,2 difference pattern. The fifth table lists the number of occurrences of twin primes in each range of 100,000 natural numbers.

AD-604 377 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE USE OF MULTI-STAGE SAMPLING SCHEMES IN MONTE CARLO COMPUTATIONS,
by Andrew W. Marshall. 3 Jun 54, 21p P-531
Unclassified report

Paper presented at Symposium on Monte Carlo Methods, Gainesville, Florida, March 17, 1954.

Descriptors: (*Monte Carlo method, Sampling), (*Sampling, Monte Carlo method), Probability, Distribution theory, Sequential analysis, Statistical processes.

The details of one of the available techniques of Monte Carlo computations, importance sampling, that can make Monte Carlo computations much more efficient if it were possible to choose judiciously the probability distribution from which the sample observations are drawn are discussed.

AD-604 381 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ASYMPTOTIC SOLUTIONS FOR A CLASS OF INTEGRAL EQUATIONS,
by Richard Latter. 9 Jul 54, 20p P-544
Unclassified report

Descriptors: (*Integral equations, Numerical analysis), Numerical methods and procedures, Integrals, Functions.

AD-604 386 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE THEORY OF DYNAMIC PROGRAMMING,
by Richard Bellman. 30 Jul 54, 25p P-550
Unclassified report

An address before the annual summer meeting of the American Mathematical Society, Laramie, Wyoming, 2 Sep 54.

Descriptors: (*Dynamic programming, Theory), Transformations (Mathematics), Functions, Equations, Probability, Differential equations, Calculus of variations.

The paper is the text of an invited address before the annual summer meeting of the American Mathematical Society at Laramie, Wyoming, September 2, 1954. The contents are chiefly of an expository nature on the theory of dynamic programming.

AD-604 390 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ANALYTICAL APPROXIMATIONS: VOLUME 15,
by Cecil Hastings, Jr. and James P. Wong, Jr.
12 Aug 54, 6p P-555
Unclassified report

Descriptors: (*Numerical analysis, Integrals), (*Integrals, Numerical analysis), Numerical methods and procedures, Statistical tests.

Analytical approximations of Chi-Square integrals are presented.

AD-604 391 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
UNIVARIATE TWO-POPULATION DISTRIBUTION-FREE DISCRIMINATION,
by D. S. Stoller. 15 Nov 54, 12p P-556
Unclassified report

Presented at the Meeting of the Institute of Mathematical Statistics, Montreal, Canada, 10-13 Sep 54.

Descriptors: (*Statistical analysis, Probability), Statistical tests, Population (Mathematics), Statistical functions (Mathematical), Classification, Equations, Psychometrics.

AD-604 392 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
RATIONAL GAME ON THE SQUARE,
by O. Gross. 10 Aug 54, 7p P-557
Unclassified report

Descriptors: (*Game theory, Mathematics), Functions, Integrals, Optimization, Integration, Equations.

An example is given of a two-person zero-sum game on the unit square, having as payoff a continuous rational function with rational coefficients and such that the only optimal strategy available to either player is the Cantor function. (Author)

AD-604 393 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.

interval of the real line, that arise in the theories of neutron transport, radiative transfer, and linearized gas dynamics. The kernels in the equations studied are functions of the difference of the arguments and involve an exponential factor. By the methods of singular integral equations, the result for the resolvent kernel is obtained in the form of simple quadratures and rapidly convergent Fredholm equations. (Author)

AD-604 461 Div. 15, 9, 20, 25
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
GREEN'S FUNCTIONS FOR ONE-VELOCITY NEUTRON TRANSPORT IN A ONE-DIMENSIONAL SLAB AND SPHERE,
by A. Leonard and T. W. Mullikin. Aug 64, 15p
RM-4206-PR
Contract AF49 638 700

Unclassified report

Descriptors: (*Green's function, Neutron transport theory), (*Neutron transport theory, Green's function), (*Transport properties, Integral equations), Scattering, Isotropism, Transformations (Mathematics), Integration, Iterative methods, Functions, Equations.

The memorandum presents an exact and efficient method of computing a well-defined resolvent, or Green's function, for one-velocity neutron transport or radiative transfer in a one-dimensional slab or sphere with isotropic scattering. It is shown that the resolvent for the slab may be simply expressed in terms of a 'complex-valued' solution to the transport equation, using the Laplace transform and contour deformation. (The procedure for computing this solution by means of simple quadratures and rapidly convergent Fredholm equations is given.) The result for the sphere resolvent, which is closely related to that for the slab, is also presented, with particular attention to the flux resulting from a point source in the center of a sphere. (Author)

AD-604 473 Div. 15, 25
OTS Prices: HC $1.00/MF $0.50

California Univ., Davis.
EXTREMA FOR EIGENVALUES OF VIBRATING SYSTEMS.
Final rept.,
by Dallas O. Banks. 1964, 12p
Grant AF AFOSR82 63
AFOSR 64 1445

Unclassified report

Descriptors: (*Vibration, Matrix algebra), (*Matrix algebra, Vibration), Energy, Mathematical analysis, Functions.

The results of two areas of research are reported. The first concerns bounds for the eigenvalues of vibrating strings. The second concerns bounds for eigenvalues of a positive symmetric definite matrix A relative to a non-negative matrix B, i.e., the values of lambda such that the system of equations (A-lambda x B)x =0 has a nontrivial solution. The results in this case are the analog of results found earlier by the investigator for the eigenvalues of a vibrating string.

AD-604 495 Div. 15
OTS Prices: HC $1.00/MF $0.50

Numerical Analysis Lab., Univ. of Wisconsin, Madison.
NUMERICAL TREATMENT OF DIFFERENTIAL EQUATIONS,
by James Thomas Day. 1964, 5p
Grant Nonr G0002 64

Unclassified report

Descriptors: (*Differential equations, Numerical analysis), (*Numerical methods and procedures, Differential equations), Boundary value problems, Integration, Trigonometry.

A Runge-Kutta Type method for the numerical solution of the differential equation y' = f(x,y), and the Goursat-Problem is presented. Some Trigonometric One-Step Methods for the Numerical Integration of a Certain Class of Order Linear Ordinary Differential Equations are discussed. Finally, the numerical solution of an N Point Boundary Value Problem for linear ordinary differential equations is presented.

AD-604 511 Div. 15
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE USE OF QUADRATIC PROGRAMMING IN STOCHASTIC LINEAR PROGRAMMING,
by E. M. L. Beale. 15 Aug 61, 26p P-2404

Unclassified report

Paper to be presented at Annual International Meeting (no. 8) of TIMS, Brussels, 23-26 Aug 61.

Descriptors: (*Quadratic programming, Linear programming), (*Linear programming, Quadratic programming), Stochastic processes, Probability, Distribution theory.

This paper presents a simple method of allowing for uncertainties in the constant terms (i.e. right hand sides) of a linear programming problem, and hence producing realistic 'safety margins' in the solution. This is done by fitting a mixture of uniform distributions to the assumed distributions of these right hand sides, and using a particular quadratic programming algorithm. (Author)

AD-604 530 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
SOME PERCENTAGE POINTS OF THE NON-CENTRAL t-DISTRIBUTION,
by Ernest M. Scheuer and Robert A. Spurgeon.
Aug 62, 14p P-2621

Unclassified report

Prepared in cooperation with Space Technology Labs., Inc.

Descriptors: (*Statistical distributions, Numerical analysis), Statistical data, Tables.

Percentage points x such that P(t/square root of f > x) = epsilon where t has the non-central t-distribution with f degrees of freedom and non-centrality parameter square root of (f + 1) K sub p (K sub P is the standard normal deviate exceeded with probability p) are tabulated for epsilon = .975, .025; p = .2500, .1500, .1000, .0650, .0400, .0250, .0100, .0040, .0025, .0010; f = 2 (1) 24 (5) 49. (Author)

AD-604 537 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.

given, together with a proof that each will terminate at the optimal r, and an upper bound on the number of comparisons required for each. (Author)

AD-604 444 Div. 15
OTS Prices: HC $3.00/MF $0.75

Union Coll., Schenectady, N. Y.
GREEN'S FUNCTIONS FOR JOURNAL BEARINGS,
by Joseph Modrey. Aug 64, 63p
Grant Nonr G00028 62, Proj. NR062 306
Unclassified report

Descriptors: (*Green's function, Journal bearings), (*Journal bearings, Green's function), Pressure, Fluid flow, Series, Transformations (Mathematics), Integrations, Functions, Differential equations.

The Green's Functions are given as the sum of a closed form function and a Fourier Series. The coefficients of the Fourier Series are given as functions of peripheral source location and journal eccentricity. With these data it is shown how the Green's Function for any L/D and source offset can be generated. Data assumes full 360 degree journal bearings but transformations are given for generating the Green's Functions for 180 degree bearings as well. The data given is applicable to both compressible and incompressible fluids. By the use of Green's Function the bearing problem is reduced from one of solving partial differential equations to one of simple integrations. The computer programming for integration is considerably simpler than that for differentiation. This simplicity enables designers not deeply versed in field equations and their convergence to perform their own analysis with minimum restrictions on geometry. (Author)

AD-604 455 Div. 15, 25
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A NOTE ON THE USE OF WICK'S THEOREM,
by A. Ramakrishnan, K. Venkatesan and V. Devanathan.
Sep 62, 11p P-2633
Unclassified report

Descriptors: (*Field theory, Theorems), (*Theorems, Field theory), Sequential analysis, Matrix algebra, Hamiltonian, Stochastic processes, Equations, Integration, Nuclear scattering, S-Matrix, Operators (Mathematics), Quantum mechanics.

A comparative study is made of the well-known method of establishing the equivalence of the field theoretic and Feynman formalisms using Wick's theorem and the method of Ramakrishnan, et. al. (Author)

AD-604 456 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE MAXIMUM CONNECTIVITY OF A GRAPH,
by Frank Harary. Feb 62, 15p P-2531
Unclassified report

Descriptors: (*Graphics, Mathematics).

The paper solves the problem of the maximum connectivity of any graph with a given number of points and lines. In addition, the minimum connectivity. The maximum diameter, and the minimum diameter are obtained. Two unsolved problems concerning the distribution of the values of the connectivity and the diameter are included.

AD-604 458 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A COMPLEMENTARY PROBLEM ON NONPLANAR GRAPHS,
by Frank Harary. Feb 62, P-2534
Unclassified report

Descriptors: (*Graphics, Theory), Euler's angles, Equations, Theorems, Geometry, Printed circuits, Networks.

It has been found empirically by John L. Selfridge, in work with networks to be used as printed circuits, that for every network with nine nodes which was encountered, either it or its complementary network could not be printed with no intersecting arcs. In terms of graph theory this conjecture asserts that for every graph G with $p = 9$ points, either G or its complementary graph G is nonplanar. If this conjecture holds for graphs with 9 points, it clearly also holds for graphs with $p > 9$ points. It was remarked in the problem that a simple argument using Euler's polyhedron formula readily demonstrates the conjecture for all graphs having $p > 11$ points. The purpose of this miscellaneous note is to supply that argument.

AD-604 459 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ASYMPTOTIC EXPANSIONS FOR THE DISTRIBUTION OF MAXIMUM DEVIATIONS IN THE BERNOULLI SCHEME,
by V. S. Korolyuk. 7 Sep 56, 8p T-66
TT 64 71239
Unclassified report

Trans. of Akad emiya Nauk SSSR. Dokl ady 1956, v. 108 no. 2 p. 183-186.

Descriptors: (*Statistical distributions, Series), (*Series, Statistical distributions), Probability, Statistical functions, Theorems.

A method of construction of asymptotic expansions for the distribution functions of maximum deviations of sums of independent random variables is presented. This method also can be applied to more general schemes, for instance, in the case of lattice random variables and random variables having a density function.

AD-604 460 Div. 15, 9, 20, 25
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
INTEGRAL EQUATIONS WITH DIFFERENCE KERNELS OF FINITE INTERVALS-II: RESOLVENT KERNELS,
by A. Leonard and T. W. Mullikin. Aug 64, 28p
RM-4235-PR
Contract AF49 638 700
Unclassified report

Descriptors: (*Integral equations, Transport properties), (*Transport properties, Integral equations), Neutron transport theory, Dynamics, Gases, Iterative methods, Transformations (Mathematics), Functions, Geometry, Heat transfer, Fluid mechanics.

In this memorandum the authors present a technique for the solution of certain integral equations, on a finite

AD-604 609 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
DECISION-MAKING IN THE FACE OF UNCERTAINTY, II,
by Richard Bellman. 8 Nov 54, 12p P-593
Unclassified report

Descriptors: (*Game theory, Decision making), (*Decision making, Game theory), Probability, Functions, Equations, Sequences.

Multi-stage processes involving both zero-sum and non-zero sum games are considered. Using the concept of 'games of survival', approximate solutions for both classes of multi-stage games under various realistic assumptions are derived. (Author)

AD-604 610 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
NOTES ON MATRIX THEORY, VI,
by Richard Bellman, Irving Glicksberg, and Oliver Gross. 10 Nov 54, 5p P-594
Unclassified report

Descriptors: (*Matrix algebra, Identities), (*Identities, Matrix algebra), (*Inequalities, Matrix algebra), Numerical methods and procedures, Theory.

An identity in matrix theory is derived which yields a number of interesting inequalities. (Author)

AD-604 611 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ANALYTICAL APPROXIMATION, VOLUME 18,
by Cecil Hastings, Jr. and James P. Wong, Jr.
11 Nov 54, 6p P-595
Unclassified report

Descriptors: (*Numerical analysis, Integrals), (*Integrals, Numerical analysis), Numerical methods and procedures.

Analytical approximations of Chi-Square integrals are presented.

AD-604 612 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
LINEAR PROGRAMMING UNDER UNCERTAINTY,
by George B. Dantzig. Rev. 8 Mar 55, 20p P-596
Unclassified report

Descriptors: (*Linear programming, Theory), Functions, Probability.

A complete computation procedure is given for a special class of two-stage linear programming models in which allocations in the first stage are made to meet an uncertain but known distribution of demands occurring in the second stage. This case, applicable to many practical problems constitutes the principal part of the paper. Next, a class of models is considered where the activities are divided into two or more stages. The quantities of activities in the first stage are the only ones that can be determined in advance because those in the second and latter stages depend on the outcome of random events. Theorems on convexity of the objective (cost) functions are established for the general m-stage case. (Author)

AD-604 613 Div. 15
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
DYNAMIC PROGRAMMING AND A NEW FORMALISM IN THE CALCULUS OF VARIATIONS I,
by Richard Bellman. 15 Nov 54, 29p P-597
Unclassified report

Descriptors: (*Dynamic programming, Calculus of variations), (*Calculus of variations, Dynamic programming), Decision theory, Functions, Equations, Power series, Integrals, Partial differential equations, Sequences, Optimization.

Various problems in the calculus of variations are considered as continuous decision processes. It is shown that the methods of the theory of dynamic programming may be utilized to yield functional equations of a new type and successive approximations of monotone type to the solutions. (Author)

AD-604 616 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ANALYTICAL APPROXIMATIONS: VOLUME 19,
by Cecil Hastings, Jr. and James P. Wong, Jr.
18 Nov 54, 7p P-601
Unclassified report

Descriptors: (*Numerical analysis, Integrals), (*Integrals, Numerical analysis), Numerical methods and procedures.

Analytical approximations of Chi-Square integrals are presented.

AD-604 617 Div. 15, 26, 30
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
CONCEPTS AND COMPUTING PROCEDURES FOR CERTAIN X SUB IJ PROGRAMMING PROBLEMS,
by Harry Markowitz. 19 Nov 54, 45p P-602
Unclassified report

Descriptors: (*Mathematical programming, Programming (Computers)), (*Programming (Computers), Linear programming), Mathematical models, Mathematical analysis, Production control, Costs.

The paper defines and applies certain concepts helpful in the analysis of such X sub ij models; it presents special computing techniques for the C sub i and C sub ij analyses; and discusses the properties, solution and application of 'embedded' X sub ij models.

AD-604 620 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ANALYTICAL APPROXIMATIONS: VOLUME 20,
by Cecil Hastings, Jr. and James P. Wong, Jr.
24 Nov 54, 6p P-607
Unclassified report

Descriptors: (*Numerical analysis, Integrals), (*Integrals, Numerical analysis), Numerical methods and

ON THE SPECTRUM OF SINGULAR BOUNDARY-VALUE PROBLEMS FOR ELLIPTIC DIFFERENTIAL EQUATIONS,
by M. Sh. Birman. 5 Oct 55, 8p T-51
TT 64 71242

Unclassified report

Trans. from Akademiya Nauk SSSR. Doklady, 1954, v. 97, no. 1.

Descriptors: (*Boundary value problems, Differential equations), (*Differential equations, Boundary value problems), Functions, Integration, Operators (Mathematics), USSR.

AD-604 538 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ON THE CAUCHY PROBLEM FOR NONLINEAR EQUATIONS IN A CLASS OF DISCONTINUOUS FUNCTIONS,
by O. A. Oleinik. 27 Jul 55, 11p T-48
TT 64 71243

Unclassified report

Trans. of Akademiya Nauk SSSR. Doklady, 1954, v. 95, no. 3, p. 451-454.

Descriptors: (*Partial differential equations, Functions), (*Functions, Partial differential equations), Equations, Functional analysis, Mathematics, USSR.

AD-604 559 Div. 15, 8, 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
MACHINE TESTING FOR DEVIATION OF DATA FROM A POISSON DISTRIBUTION,
by F. A. Hadden. Rev. 8 Nov 54, 8p P-578

Unclassified report

Descriptors: (*Statistical data, Data processing systems), (*Data processing systems, Statistical data), Electron tubes, Failure (Mechanics), Probability, Statistical analysis.

In a population of events that are normally expected to occur according to the Poisson distribution, certain events may occur as the results of special factors which operate in relation to them only. In such cases, these specially influenced events will not fall within the Poisson distribution that describes the rest of the population. It may be desirable to study the factors causing their peculiar occurrence, and this will require that the abnormally occurring events be separated from the normally occurring ones. This paper outlines a practical machine method for making this kind of separation for any data that is Poisson distributed. For clarity, the techniques will be described in terms of a particular example, the in-flight failure of vacuum tubes in a piece of airborne electronic equipment. (Author)

AD-604 563 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A PROBLEM IN THE SEQUENTIAL DESIGN OF EXPERIMENTS,
by Richard Bellman. 20 Oct 54, 18p p-586

Unclassified report

Descriptors: (*Dynamic programming, Sequences), Optimization, Functions, Equations, Stochastic processes.

The problem of determining an optimal testing policy where one simultaneously gains and learns for the case where the outcome of one choice is known and the other is subject to a known a priori distribution is considered. Results of Johnson and Karlin, P-328, are obtained in a different way and extended. The methods used are applicable to more general processes. (Author)

AD-604 565 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
FULLY CONVEX NORMED LINEAR SPACES,
by Ky Fan and Irving Glicksberg. 1 Nov 54, rev. 17 Jun 55, 17p P-588

Unclassified report

Prepared in cooperation with University of Notre Dame.

Descriptors: (*Functional analysis, Sequences), (*Sequences, Functional analysis), Convex sets, Topology, Theorems.

AD-604 566 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
DYNAMIC PROGRAMMING AND MULTI-STAGE DECISION PROCESSES OF STOCHASTIC TYPE,
by Richard Bellman. 2 Nov 54, 20p P-589

Unclassified report

Descriptors: (*Dynamic programming, Stochastic processes), (*Stochastic processes, Dynamic programming), Optimization, Learning, Functions, Equations, Sequences.

The paper is a summary of some applications of the theory of dynamic programming to various classes of multi-stage decision problems of stochastic type. (Author)

AD-604 607 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A NOTE ON THE MEAN VALUE OF RANDOM DETERMINANTS,
by Richard Bellman. 2 Nov 54, 5p P-590

Unclassified report

Descriptors: (*Determinants, Distribution theory), Operators (Mathematics), Matrix algebra, Probability, Functional analysis.

An explicit expression for the moments of a random determinant is presented.

AD-604 608 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ANALYTICAL APPROXIMATIONS, VOLUME 17,
by Cecil Hastings, Jr. and James P. Wong, Jr.
5 Nov 54, 6p P-592

Unclassified report

Descriptors: (*Numerical analysis, Integrals), (*Integrals, Numerical analysis), Numerical methods and procedures.

Analytical approximations of Chi-Square integrals are presented.

methods and procedures, Equations, Identities, Functional analysis.

The purpose of this paper is to illustrate the application of the min-max theorem of game theory to the solution of some classes of variational problems involving non-analytic functionals. (Author)

AD-604 639 Div. 15
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE OPTIMIZATION OF A QUADRATIC FUNCTION SUBJECT TO LINEAR CONSTRAINTS,
by Harry Markowitz. Rev. 27 Jun 55, 35p P-637
Unclassified report

Descriptors: (*Nonlinear programming, Optimization), Functions, Set theory, Convex sets, Linear programming, Quadratic programming.

AD-604 640 Div. 15
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
VARIATIONAL PROBLEMS WITH CONSTRAINTS,
by R. Bellman, W. H. Fleming, and D. V. Widder.
23 Feb 55, 40p P-639
Unclassified report

Descriptors: (*Calculus of variations, Dynamic programming), (*Dynamic programming, Calculus of variations), Integrals, Functions, Theorems.

The problem considered is that of maximizing an integral $F(x,y)dt$ subject to $x' = G(x,y)$, $x(O) = c$, and $O < or = y < or = x$. An essentially new feature is determining in what regions $y = x$, $O < y < x$, and $y = O$. (Author)

AD-604 641 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
NOTES IN THE THEORY OF DYNAMIC PROGRAMMING. IV: A VARIATIONAL PROBLEM WITH CONSTRAINTS,
by Richard Bellman. 28 Feb 55, 25p P-640
Unclassified report

See also AD-604 634

Descriptors: (*Dynamic programming, Theory), Functions, Equations, Partial differential equations, Integrals, Decision theory, Optimization.

The purpose of the paper is to illustrate how the functional equation technique of the theory of dynamic programming may be employed to treat a class of variational problems with constraints. (Author)

AD-604 647 Div. 15, 26
OTS Prices: HC $3.00/MF $0.75

RAND Corp., Santa Monica, Calif.
MATHEMATICAL ASPECTS OF SCHEDULING THEORY,
by Richard Bellman. Rev. 23 May 55, 75p P-651
Unclassified report

Descriptors: (*Scheduling, Mathematics), Production control, Mathematical models, Dynamic programming, Permutations, Queueing theory, Matrix algebra, Transportation, Topology, Linear programming, Numerical analysis, Polynomials, Computers, Calculus of variations, Stochastic processes, Game theory, Iterative methods, Operations research, Mathematical analysis.

The purpose of this paper is to formulate a number of significant mathematical problems which have arisen in connection with the theory of scheduling, and to discuss the methods which have been devised to treat these problems. (Author)

AD-604 648 Div. 15, 26, 32
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
RECENT ADVANCES IN LINEAR PROGRAMMING,
by George B. Dantzig. 12 Apr 55, 32p P-652
Unclassified report

Descriptors: (*Linear programming, Reviews), Operations research, Management engineering, Numerical methods and procedures.

Three topics: uncertainty, combinatorial problems, and large scale systems are discussed.

AD-604 666 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
SOME SIMPLEX-LIKE NONLINEAR PROGRAMMING PROCEDURES,
by Philip Wolfe. Sep 61, 19p P-2446
Unclassified report

Descriptors: (*Nonlinear programming, Numerical methods and procedures), (*Numerical methods and procedures, Nonlinear programming), Functions, Convex sets, Quadratic programming.

Four computational techniques, based on the simplex method, for the solution of nonlinear programming problems are described and compared. (Author)

AD-604 672 Div. 15
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A SHORT TABLE OF PRIME NUMBERS,
by George Armerding and Fred Gruenberger.
Dec 61, 40p P-2500
Unclassified report

Descriptors: (*Prime numbers, Tables), Numbers.

The first 9500 prime numbers (considering unity as a prime) are listed here together with an index number (from 1 to 9500). (Author)

AD-604 705 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
FUNCTIONAL EQUATIONS IN THE THEORY OF DYNAMIC PROGRAMMING: II: NONLINEAR DIFFERENTIAL EQUATIONS,
by Richard Bellman. 5 May 55, 6p P-671
Unclassified report

See also AD-293 678

procedures.

Analytical approximations of Chi-Square integrals are presented.

AD-604 622 Div. 15, 26, 32
OTS Prices: HC $3.00/MF $0.75

RAND Corp., Santa Monica, Calif.
A LINEAR PROGRAMMING SOLUTION TO DYNAMIC LEONTIEF TYPE MODELS,
by Harvey M. Wagner. 27 Aug 54, 59p P-609
Unclassified report

Descriptors: (*Linear programming, Matrix algebra), (*Matrix algebra, Linear programming), (*Economics, Mathematical models), Industrial production, Industrial procurement, Difference equations, Operations research.

This paper presents a general dynamic model of an economy and attempts to answer a number of questions dealing, for example, with the feasibility of certain time profiles of demand, the rate of substitution between economic activities taking place in different time periods, economic growth, and industrial cycles; undoubtedly there are many more applications of the general model. The solutions to the questions involve the application of linear programming to a standard Leontief input-output flow matrix and a capital building matrix. In addition the paper proposes a method which is designed to reduce computation time considerably. (Author)

AD-604 629 Div. 15
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ON GAMES OF SURVIVAL,
by J. Milnor and L. S. Shapley. 10 Oct 56, 45p
P-622, rev.
Unclassified report

Descriptors: (*Game theory, Survival), Probability, Matrix algebra, Sequences, Equations, Functional analysis, Numerical methods and procedures.

In a game of survival, two players with limited resources play a zero-sum game repeatedly until one of them is ruined. The solution of the survival game gives one a measure of the value of resources in terms of survival probabilities. In this paper the zero-sum game is expressed as a finite matrix, but with (possibly) incommensurable entries; hence the number of different distributions of resources that can occur during a single play may be infinite. The existence of a value and optimal strategies is proved, using the theory of semi-martingales. A simple approximation to the solution is described, and several examples are discussed. (Author)

AD-604 632 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
MARKETS AS COOPERATIVE GAMES,
by L. S. Shapley. 7 Mar 55, 7p P-629
Unclassified report

Descriptors: (*Game theory, Economics), Functions, Set theory.

Markets are formulated as cooperative n-person games in which the players are divided into two camps, the buyers and the sellers, with some kind of profitable exchange going on between them. The solutions of several examples are discussed and a general notion of 'abstract market game' is defined. (Author)

AD-604 633 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
NOTES IN THE THEORY OF DYNAMIC PROGRAMMING. II: A FUNCTIONAL EQUATION ARISING IN ALLOCATION THEORY,
by Richard Bellman. 25 Jan 55, 9p P-631
Unclassified report

Descriptors: (*Dynamic programming, Theory), Functions, Equations, Optimization.

The structure of the solution of $f(x) = \text{Max } (0<y<x)$ $(g(y)+h(x-y)+f(ay+b(x-y)))$, in the case where g and h are concave is derived.

AD-604 634 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
NOTES IN THE THEORY OF DYNAMIC PROGRAMMING. III: EQUIPMENT REPLACEMENT POLICY,
by Richard Bellman. 26 Jan 55, 8p P-632
Unclassified report

See also AD-604 633

Descriptors: (*Dynamic programming, Theory), Functions, Equations, Economics, Optimization.

The functional equation technique of the theory of dynamic programming is applied to the theory of equipment replacement. (Author)

AD-604 637 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
PERTURBATION METHODS IN APPLIED MATHEMATICS,
Richard Bellman. 10 Feb 55, 14p P-635
Unclassified report

Descriptors: (*Perturbation theory, Mathematics), (*Power series, Numerical methods and procedures), Equations, Numerical analysis.

The paper presents a simple technique which will in many cases increase the range of effectiveness of perturbation and power series methods in situations in which the equations treated contain parameters which assume only positive values. (Author)

AD-604 638 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
SOME NONCLASSICAL PROBLEMS IN THE CALCULUS OF VARIATIONS,
by R. Bellman, I. Glicksberg, and O. Gross.
17 Feb 55, 14p P-636
Unclassified report

Descriptors: (*Calculus of variations, Game theory), (*Game theory, Calculus of variations), Numerical

AD-604 724 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
SOME ASPECTS OF THE THEORY OF DYNAMIC PROGRAMMING,
by Richard Bellman. 23 Jun 55, 13p P-696
Unclassified report

Descriptors: (*Dynamic programming, Theory), Decision theory, Sequences, Functions, Equations, Probability, Optimization.

The purpose of the paper is to furnish a simple introduction to the use of the theory of dynamic programming in treating multi-stage decision processes. (Author)

AD-604 726 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE TOPOLOGY OF FINITARY APPROXIMATION,
by David Ellis. 20 Jun 55, rev. 2 Aug 55, 12p P-698
Unclassified report

Descriptors: (*Topology, Set theory), (*Set theory, Topology), Functions, Mapping (Transformations).

This paper contemplates a certain resonably strong (d.h. at least as many accumulation points as pointwise convergence) topology in the space of functions mapping an arbitrary set into an arbitrary metric space. (Author)

AD-604 765 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ON A PROBLEM OF THE COMPARISON OF TWO EMPIRICAL DISTRIBUTIONS,
by B. V. Gnedenko and E. L. Rvacheva. 2 Jun 55, 8p T-45
TT 64 71259
Unclassified report

Ob Odnoi Zadache Sravneniya Dvukh Empiricheskikh Raspredelenii; trans. of Akademiya Nauk SSSR. Doklady, 1952, v. 82, no. 4, p. 513-516.

Descriptors: (*Statistical functions, Correlation techniques), (*Correlation techniques, Statistical functions), Series, Probability, Particle trajectories, Set theory, Statistical analysis, USSR.

A method of solving the problem of the divergence of empirical distribution functions is presented.

AD-604 770 Div. 15
OTS Prices: HC $3.00/MF $1.00

RAND Corp., Santa Monica, Calif.
THE THEORY OF LINEAR INEQUALITIES,
by Theodor Motzkin. 7 Mar 52, 90p T-22
TT 64 71264
Unclassified report

Trans. of an unidentified mono. n.p., n.d.

Descriptors: (*Inequalities, Theory), Set theory, Matrix algebra, Transformations (Mathematics), Convex sets, Game theory, Calculus of variations, Determinants, Analytic geometry.

AD-604 790 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
SOLUTION OF A GAME WITH CONSTRAINTS,
by R. Wagner. 30 Jun 50, 18p RM-414
Unclassified report

Descriptors: (*Game theory, Calculus of variations), (*Calculus of variations, Game theory), Set theory, Convex sets, Mapping (Transformations), Optimization.

AD-604 797 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A THEORY OF PURSUIT AND EVASION,
by C. Ryll-Nardzewski. Aug 62, 22p P-2606
Unclassified report

Descriptors: (*Game theory, Set theory), (*Set theory, Game theory), (*Topology, Game theory), Optimization, Operations research, Inequalities, Functions, Determinants, Control, Theory.

The purpose of this paper was to present an approach to the theory of pursuit and evasion with perfect information based only on general topological and set theoretical notions. The author's definition of the strategy is rather strange because multivalued strategies are allowed, such a strategy prescribes to a given motion of the enemy a whole class of possible motions. The schema adopted in this paper is general enough to enclose the pursuit and evasion with some restrictions on velocities or accelerations (which may depend on the positions and directions of motions--for this reason any metric distance functions are introduced. The payoff function is the amount of time used by the pursuer and the evader to reach a configuration from a given set of final configurations.

AD-604 799 Div. 15, 32
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
SOME MONTE CARLO ESTIMATES OF THE YULE DISTRIBUTION,
by H. A. Simon and T. A. VanWormer. Jul 62, 30p P-2599
Unclassified report

Descriptors: (*Monte Carlo method, Stochastic processes), (*Stochastic processes, Monte Carlo method), Simulation, Distribution theory, Vocabulary, Sampling, Documentation.

This paper presents some Monte Carlo simulations of the Yule process, viewed as a stochastic process for generating the frequency distributions of words in text. In the first part, data are presented for the case, which cannot be solved analytically in closed form, where the rate at which new words enter the text is variable. In the second part, Monte Carlo simulations are compared with two sets of data where both the empirical frequency distributions and the actual rate at which words enter the text are known. (Author)

AD-604 846 Div. 15
OTS Prices: HC $1.00/MF $0.50

Stanford Univ., Calif.
SPECIALIZED MULTIVARIATE BEHRENS-FISHER PROBLEMS,
by Sheldon James Press. Aug 64, 14p P-2962
Grant NSF GP214 Unclassified report

Descriptors: (*Dynamic programming, theory), (*Functions, Equations), (*Nonlinear differential equations, Dynamic programming).

The study of dynamic programming processes of continuous type gives rise to functional equations of the form dx/dt = Max/q f (x,t;q). In this paper we present a summary of some basic results concerning the existence and uniqueness of solutions of this equation. Detailed results will appear subsequently. (Author)

AD-604 708 Div. 15
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
FUNCTIONAL EQUATIONS IN THE THEORY OF DYNAMIC PROGRAMMING: III: MULTI-STAGE GAMES, by Richard Bellman. 13 May 55, rev. 14 Mar 56, 33p P-676
Unclassified report

See also AD-604 705

Descriptors: (*Dynamic programming, Game theory), (*Game theory, Dynamic programming), (*Functions, Equations), Optimization, Stochastic processes, Sequences, Differential equations, Probability.

The paper establishes existence and uniqueness theorems for a class of functional equations occurring in the theory of multi-stage games. (Author)

AD-604 709 Div. 15, 5, 7, 33
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
COMPUTATION OF MAXIMAL FLOWS IN NETWORKS, by D. R. Fulkerson and G. B. Dantzig. 1 Apr 55, 18p P-677
Unclassified report

Descriptors: (*Linear programming, Networks), (*Networks, Linear programming), Algebraic topology.

A simple computational method, based on the simplex algorithm of linear programming, is proposed for the following problem: 'Consider a network (e.g., rail, road, communication network) connecting two given points by way of a number of intermediate points, where each link of the network has a number assigned to it representing its capacity. Assuming a steady state condition, find a maximal flow from one given point to the other.' (Author)

AD-604 710 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
CECH COMPACTIFICATIONS OF PRODUCTS, by Irving Glicksberg. 16 May 55, 7p P-678
Unclassified report

Descriptors: (*Topology, Theorems), Set theory, Functional analysis.

The purpose of this note is to point out the following easily obtained relationships between pseudo-compactness and Cech compactifications of certain product spaces: (a) If beta (X x Y) = beta(X) x beta (Y) and neither X nor Y is finite, then X, Y and X x Y are pseudo-compact; (b) if X and Y are pseudo-compact, and one is locally compact, beta (X x Y) = beta (X) x beta (Y); where beta (X) denotes the Cech compactification of X. Combined, the conditions yield one apparently new fact about pseudo-compact spaces: A finite product of pseudo-compact spaces, all but one of them locally compact, is pseudo-compact. (Author)

AD-604 711 Div. 15
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE ELIMINATION FORM OF THE INVERSE AND ITS APPLICATION TO LINEAR PROGRAMMING, by Harry Markowitz. 8 Apr 55, 29p P-680
Unclassified report

Descriptors: (*Linear programming, Matrix algebra), Operations research, Transformations (Mathematics), Iterative methods, Set theory.

The paper discusses a particular product form of inverse which is closely related to the Gaussian elimination method of solving a set of simultaneous equations. This 'elimination form of the inverse' is especially valuable when A has a large number of zero coefficients. If A has no zero coefficients, on the other hand, the elimination form of inverse is still generally as convenient as the conventional A (-1). (Author)

AD-604 712 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
NOTE ON A THEOREM OF DILWORTH, by D. R. Fulkerson. 11 Apr 55, 7p P-681
Unclassified report

Descriptors: (*Set theory, Mathematical analysis), Theorems.

A theorem due to Dilworth on chain decompositions of partially ordered sets is shown to be a consequence of Menger's theorem in the theory of linear graphs. (Author)

AD-604 717 Div. 15, 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
COMPUTING EXPERIENCE WITH LINEAR PROGRAMMING AND ITS VARIANTS, by William Orchard-Hays. 8 Aug 55, 14p P-688
Unclassified report

Descriptors: (*Linear programming, Programming, (Computers)), (*Programming (Computers), Linear programming), Mathematical models, Matrix algebra, Numerical methods and procedures, Optimization, Iterative methods, Industrial production.

The application of linear programming to complex problems gives rise to the handling of large matrix problems. The simplex method proved to be the most expedient of any tried but, since this is essentially Gaussian elimination, numerical techniques for handling it have definite limitations, both with regard to running time and memory size. RAND's simplex codes for the IBM 701 were designed, through revisions to the method and special compiling routines, to maintain great precision and facilitate checking, to be adaptable to many variations, and to be as automatic in operation as possible. Several quite large models of considerable variety are discussed along with the prospects for future improvements, both in theory and in coding techniques. (Author)

AD-604 927 Div. 15
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ON DIFFERENTIAL GAMES WITH INTEGRAL PAYOFF,
by L. D. Berkovitz and W. H. Fleming.
10 Aug 55, 34p P-717
Unclassified report

Descriptors: (*Integrals, Game theory), (*Game theory, Calculus of variations), (*Calculus of variations, Game theory), Differential equations, Functions, Theorems.

Methods of the calculus of variations were employed to obtain necessary conditions that differential games of a certain type have a saddle-point. By strengthening the necessary conditions, sufficient conditions for the existence of a saddle-point and a method of constructing the saddle-point were derived. (Author)

AD-604 928 Div. 15, 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE PROBLEM OF CONTINUOUS PROGRAMS,
by Howard Osborne. 12 Aug 55, 20p P-718
Unclassified report

Descriptors: (*Dynamic programming, Difference equations), (*Sequences, Theorems), Optimization, Functional analysis, Set theory, Mathematical programming, Economics, Calculus of variations.

A convergence theorem is presented under specific assumptions on the form of the difference equations which define the process, rather than on their solutions. (Author)

AD-604 932 Div. 15
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
FAMILIES OF TRANSFORMATIONS IN THE FUNCTION SPACES H (p),
by P. Swerling. 19 Aug 55, 38p P-722
Unclassified report

Descriptors: (*Transformations (Mathematics), Functional analysis), (*Functional analysis, Transformations (Mathematics)), Functions, Operators (Mathematics), Mapping (Transformations), Series, Set theory, Complex numbers, Groups (Mathematics).

AD-604 935 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A NOTE ON RANDOMIZED BRANCH SAMPLING,
by A. W. Marshall. 26 Aug 55, 8p P-725
Unclassified report

Descriptors: (*Monte Carlo method, Sampling), (*Sampling, Probability), Statistical distributions, Statistical analysis, Fruits, Counting methods, Effectiveness.

In this paper the author discusses the randomized branch sampling plans, indicates how and why they work, shows how the statistical idea behind these sampling plans is the same as the idea of importance sampling developed in Monte Carlo calculations, and suggests some refinements of Professor Jessen's method of estimating the fruit count on a tree by randomized branch sampling based upon their identity with importance sampling.

AD-604 937 Div. 15
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE EXISTENCE OF STATIONARY MEASURES FOR CERTAIN MARKOV PROCESSES,
by T. E. Harris. 31 Aug 55, 30p P-728
Unclassified report

Descriptors: (*Statistical processes, Measure theory), Distribution theory, Statistical distributions, Set theory, Probability, Statistical functions.

The idea of a stationary distribution for a Markov process can be extended to include 'distribution' or measures which are infinite. It is shown that a certain type of recurrence condition implies the existence of a possible infinite stationary measure. Applications are discussed. (Author)

AD-604 939 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A SYSTEMATIC APPROACH TO A CLASS OF PROBLEMS IN THE THEORY OF NOISE AND OTHER RANDOM PHENOMENA. II EXAMPLES,
by A. J. F. Siegert. 1 Sep 55, 24p P-730
Unclassified report

Prepared in cooperation with Northwestern Univ., Evanston, Ill.

Descriptors: (*Statistical processes, Noise), (*Noise, Theory), Probability, Functions, Integral equations, Noise (Radio).

AD-604 940 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A NEW TECHNIQUE FOR EIGENVALUE PROBLEMS, I,
by Howard Osborn. 2 Sep 55, 22p P-731
Unclassified report

Descriptors: (*Calculus of variations, Equations), (*Complex numbers, Differential equations), Optimization, Inequalities, Functions, Linear programming, Number theory.

A functional equation is developed for the variational problem associated with the lowest eigenvalue of the given differential equation; the development is in part modelled after that of Bellman's formalism for non-isoperimetric variational problems in the calculus of variations.

AD-604 944 Div. 15, 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ON THE PARTITION OF THE VERTICES OF AN n-CUBE BY AN (n-1)-PLANE,
by S. S. Cairns. 7 Sep 55, 20p P-735
Unclassified report

Descriptors: (*Linear programming, Convex sets), (*Convex sets, Linear programming), Set theory, permutations, Inequalities, Geometric forms, Conformal mapping.

AD-604 945 Div. 15, 30
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.

Descriptors: (*Statistical analysis, Statistical tests), (*Statistical tests, Statistical analysis), Matrix algebra, S-matrix, Transformations (Mathematics), Statistical distributions, Mathematical models, Optimization.

AD-604 855 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
DYNAMIC PROGRAMMING IN MULTIPLICATIVE LATTICES,
by T. A. Brown and R. E. Strauch. Aug 64, 20p
RM-4208-PR
Contract AF49 638 700
Unclassified report

Descriptors: (*Dynamic programming, Algebra), Topology, Theorems, Functions, Mathematical programming, Optimization.

This Memorandum demonstrates that the methods of dynamic programming may be applied to problems involving partially ordered criterion functions; specifically, the existence of optimal policies and the principle of optimality are established for a category of problems in which the criterion space is a conditionally complete multiplicative lattice. (Author)

AD-604 916 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
FUNCTIONAL EQUATIONS IN THE THEORY OF DYNAMIC PROGRAMMING; V: POSITIVITY AND QUASI-LINEARITY,
by Richard Bellman. 11 Jul 55, 8p P-704
Unclassified report

Descriptors: (*Dynamic programming, Equations), (*Equations, Dynamic programming), Differential equations, Partial differential equations, Calculus of variations, Functional analysis.

We determine conditions under which the solution of u(p) = Max sub q L(u,p,q)+a(p,q) may be written u(p) = Max sub q v(p,q), where v(p,q) is the solution of v(p) = L(v,p,q) +a(p,q) for arbitrary q = q(p). (Author)

AD-604 917 Div. 15, 32
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
REDUCTION OF CONSTRAINED MAXIMA TO SADDLE-POINT PROBLEMS,
by Kenneth J. Arrow and Leonid Hurwicz. 7 Jul 55, 48p P-706
Unclassified report

Partly supported by the Office of Naval Research.

Descriptors: (*Calculus of variations, Game theory), (*Game theory, Economics), (*Numerical analysis, Partial differential equations), Optimization, Linear programming, Scheduling, Vector analysis, Functional analysis.

AD-604 922 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A THEOREM ON DESCRIPTION ADEQUACY,
by David Ellis. 2 Aug 55, 8p P-712
Unclassified report

Descriptors: (*Topology, Theorems), Set theory, Operators (Mathematics), Mapping (Transformation), Algebraic topology.

Propositions asserting the adequacy of certain classes of nets in a topological space to describe the topology of the space are discussed and a new such class, based on the notion of selection operator, is adduced. (Author)

AD-604 924 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ON A CLASS OF VARIATIONAL PROBLEMS,
by Richard Bellman. 3 Aug 55, 14p P-714
Unclassified report

Descriptors: (*Calculus of variations, Functional analysis), (*Functional analysis, Calculus of variations), Differential equations, Dynamic programming, Boundary value problems, Scheduling, Numerical analysis.

The problem of determining the minimum of a functional is treated using the functional equation technique of the theory of dynamic programming. The problem is reduced to the solution of a system of ordinary differential equations satisfying one-point boundary conditions. The discrete case, corresponding to the minimization of a class of quadratic forms, is also treated by the same general method. A particular problem of this type arises in the treatment of the optimal inventory problem by Holt, Simon, and Modigliani.

AD-604 925 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
NOTES ON MATRIX THEORY-IX,
by Richard Bellman. Rev. 26 Jan 56, 8p P-715
Unclassified report

Descriptors: (*Matrix algebra, Theory), (*Indentities, Integrals), (*Integrals, Identities), Inequalities, Special functions (Mathematical), Real numbers, Theorems.

This paper is concerned with establishing a concavity theorem for power products with the aid of a generalization of an identity of Siegel.

AD-604 926 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ON A GENERALIZATION OF SOME INTEGRAL IDENTITIES DUE TO INGHAM AND SIEGEL,
by Richard Bellman. 8 Aug 55, 16p P-716
Unclassified report

Descriptors: (*Identities, Integrals), (*Integrals, Identities), Special functions (Mathematical), Determinatnts, Number theory, Equations, Series, Matrix algebra.

This paper evaluates generalizations of multi-dimensional integrals due to Ingham and Siegel, and gives a number of applications of these results. (Author)

(*Dynamic programming, Theory), (*Equations, Dynamic programming), Calculus of variations, Differential equations, Numerical analysis, Difference equations, Vector analysis, Servomechanisms, Engineering, Economics.

The functional equation technique of the theory of dynamic programming is applied to the problem of determining the minimum of the maximum deviation of a system from a preassigned state. The problem is that of choosing y, a vector function of t, so as to minimize the maximum deviation of x(t) from a given vector z(t), over a fixed interval $0 < t < T$.

AD-604 965 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
TRANSIENT MARKOV CHAINS WITH STATIONARY MEASURES,
by T. E. Harris. 11 Nov 55, 12p P-767
Unclassified report

Descriptors: (*Probability, Statistical processes), Measure theory, Matrix algebra, Sequences, Set theory, Calculus of variations, Theorems.

In this note conditions are given for the existence of solutions of the 'equations of stationarity' where the markov chain is transient. A necessary condition and a sufficient condition for the existence of a solution was obtained and the main results are given in two theorems.

AD-604 967 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ON CONVERSES OF SCHWARTZ'S INEQUALITY,
by Richard Bellman. 22 Nov 55, 12p P-770
Unclassified report

Descriptors: (*Inequalities, Numerical analysis), Functions, Calculus of variations, Numerical methods and procedures.

The purpose of this paper is to present a general method for treating questions involving the converse of the Schwarz and Holder inequalities. (Author)

AD-604 969 Div. 15
OTS Prices: HC $1.001/MF $0.50

RAND Corp., Santa Monica, Calif.
LIMIT THEOREMS FOR NONCOMMUTATIVE PROCESSES--II: ON A GENERALIZATION OF THE STIELTJES INTEGRAL,
by Richard Bellman. 28 Nov 55, 12p P-772
Unclassified report

Descriptors: (*Measure theory, Integrals), (*Integrals, Matrix algebra), (*Matrix algebra, Integrals), Functions, Series, Sequences, Probability, Theorems.

This paper presents two generalizations of the Riemann-Stieltjes integral arising from the study of positive definite matrices. (Author)

AD-604 971 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ON A GENERALIZATION OF THE FUNDAMENTAL IDENTITY OF WALD,
by Richard Bellman. Rev. 23 Jan 56, 8p P-777
Unclassified report

Descriptors: (*Identities, Sequential analysis), (*Sequential analysis, Identities), Statistical functions, Stochastic processes, Matrix algebra, Equations, Statistical analysis, Sequences.

This paper extends the fundamental identity of Wald in the theory of sequential analysis to the case where the variables are Markovian rather than independent. (Author)

AD-604 972 Div. 15, 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A PRIMAL--DUAL ALGORITHM,
by G. B. Dantzig, L. R. Ford, Jr., and D. R. Fulkerson.
Rev. 9 May 56, 18p P-778
Unclassified report

Descriptors: (*Linear programming, Optimization), Iterative methods, Calculus of variations, Mathematical programming, Errors, Numerical analysis, Geometry, Functions, Scheduling, Transportation.

The procedure developed by two of the authors (Ford and Fulkerson) for solving transportation problems is a natural extension of the Kuhn-Egervary method for solving assignment problems. In the present paper the procedure is extended further to the general linear programming case. (Author)

AD-604 974 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
DYNAMIC PROGRAMMING AND THE NUMERICAL SOLUTION OF VARIATIONAL PROBLEMS,
by Richard Bellman. 8 Dec 55, 24p P-780
Unclassified report

Descriptors: (*Dynamic programming, Calculus of variations), (*Calculus of variation, Dynamic programming) Numerical analysis, Numerical methods and procedures.

A simple, readily applicable technique, requiring no mathematical background beyond elementary calculus, which can be used to compute the solution of a variety of problems in a routine fashion, with no regard to linear or nonlinear, stochastic or deterministic features of the underlying processes is present. (Author)

AD-604 975 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
AN ABSTRACT SETTING FOR THE NOTION OF DYNAMIC PROGRAMMING,
by David Ellis. 15 Nov 55, 14p P-783
Unclassified report

Descriptors: (*Dynamic programming, Set theory), (*Set theory, Dynamic programming), Algebra, Theory, Optimization, Decision theory.

After a brief resume of the needed concepts, the notion of a dynamic programming process is axiomatized and an appropriate version of the 'Principle of Optimality' is shown as a consequence. (Author)

BALANCE SCALE SORTING,
by S. S. Cairns. 7 Sep 55, 40p P-736
Unclassified report

Descriptors: (*Linear programming, Optimization), Set theory, Probability, Series, Combinatorial analysis Inequalities, Mathematical programming.

Given (1) a set W of n objects, indistinguishable save that the members of a subset H of h objects are slightly heavier than the rest (2) a balance scale, one seeks weighing programs minimizing either (Problem M(n,h)) the maximum number of weighings which may be required to cull out H or (Problem E(n,h)) the expected number of such weighings. Problem M(n,1) is a familiar puzzle. Problem E(n,1) was solved under various hypotheses. Problem M(n,2) was partially solved. Some aspects of it require further investigation. The paper could be used as a basis for more research on M(n,h) and E(n,h) in general. Some of the techniques involve manipulations of series which may be applicable to other combinatorial problems. (Author)

AD-604 950 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ON DIFFERENTIAL GAMES WITH SURVIVAL PAYOFFS,
by Herbert Scarf. 22 Sep 55, 20p P-742
Unclassified report

Descriptors: (*Game theory, Differential equations), Functions, Operators (Mathematics), Boundary value problems, Optimization, Calculus of variations, Probability, Matrix algebra.

A class of survival games is considered in an arbitrary n-dimensional region R, and with an arbitrary payoff function f(x) on the boundary. If the steps are uniformly decreased in size, the equations specifying the changes in the state of the game tend to approximate the equations of a differential game. A particular class of games is treated in which neither player can force the state of the game to proceed in any direction. It is shown that under certain conditions, the upper and lower values of the approximating games actually converge to the same function. The limiting value is given by the solution of L(V) = O, with boundary value f(x), where L(V) is a certain second-order differential operator associated with the game. (Author)

AD-604 951 Div. 15
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
DEGREES OF COMPUTABILITY,
by Norman Shapiro. 3 Oct 55, 40p P-744
Unclassified report

Descriptors: (*Decision theory, Mathematical logic), (*Mathematical logic, Decision theory), Recursive functions, Set theory, Number theory, Numerical analysis, Real numbers.

An investigation is made of the degrees of computability (in the theoretical sense) of certain decision problems. The Kleene hierarchy is extended to partial relations. (Author)

AD-604 957 Div. 15, 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
NOTES ON MATRIX THEORY-X: A PROBLEM IN CONTROL,
by Richard Bellman. 19 Oct 55, 6p P-755
Unclassified report

Descriptors: (*Matrix algebra, Theory), (*Control, Theory), (*Integrals, Differential equations), Determinants, Polynomials.

In the theory of control processes, it is important to be able to calculate the integral of (x, Bx) dt between o and infinity without having to solve explicitly the differential equation dx/dt = Ax, x(O) = c. A method for doing this is presented in this paper, generalizing one due to Anke for nth order linear differential equation. (Author)

AD-604 958 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
AN INTRODUCTORY NOTE: FOR THE PROCEEDINGS OF THE GAINSESVILLE, FLORIDA, SYMPOSIUM ON MONTE CARLO METHODS,
by A. W. Marshall. 24 Oct 55, 18p P-756
Unclassified report

Descriptors: (*Monte Carlo method, Symposia), (*Symposia, Monte Carlo method), Numerical analysis, Probability, Analog systems, Statistical mechanics, Sequential analysis, Sampling, Computers.

The report is concerned with the Monte Carlo method as a tool of numerical analysis. The progress of the method from the late forties to the present is described. Early applications and the initial development of the sampling technique as well as the current state of the Monte Carlo method are discussed.

AD-604 962 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
NOTE ON B. KLEIN'S 'DIRECT USE OF EXTREMAL PRINCIPLES IN SOLVING CERTAIN PROBLEMS INVOLVING INEQUALITIES',
by George B. Dantzig. Rev. 29 Jan 57, 10p P-763
Unclassified report

Descriptors: (*Linear programming, Complex variables), (*Inequalities, Calculus of variations), (*Calculus of variations, Inequalities), Optimization, Partial differential equations, Numerical analysis.

In the May, 1955 issue of the Journal of the Operations Research Society of America, B. Klein proposed that ordinary methods of the differential calculus be used to minimize a function z of n variables x sub 1, x sub 2 . . ., x sub n, where the latter are subject to inequality constraints instead of the usual equality constraints. This report discusses whether this proposal can be used constructively to determine the optimum. (Author)

AD-604 964 Div. 15, 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
NOTES ON CONTROL PROCESSES. I. ON THE MINIMUM OF MAXIMUM DEVIATION,
by Richard Bellman. 10 Nov 55, 10p P-765
Unclassified report

Descriptors: (*Control, Dynamic programming),

Legibility of this document is in part unsatisfactory. Reproduction has been made from best available copy.

Descriptors: (*Transportation, Scheduling), (*Linear programming, Optimization), Calculus of variations, Set theory, Combinatorial analysis, Mathematical programming, Management engineering.

An algorithm for solving capacitated Hitchcock problems is outlined, and a proof of convergence in a finite number of steps is given. The proposed algorithm is a generalization of a combinatorial method discovered by Kuhn for the optimal assignment problem; it uses as a subroutine the 'flow' algorithm previously developed by the authors. (Author)

AD-605 018 Div. 15, 1
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
APPLICATION OF DYNAMIC PROGRAMMING TO THE AIRPLANE MINIMUM-TO-CLIMB PROBLEM,
by T. F. Cartaino and S. E. Dreyfus. Rev. 18 Jan 57, 44p P-834
Unclassified report

Descriptors: (*Dynamic programming, Aircraft), (*Climbing, Aircraft), Equations, Functions, Decision theory.

The dynamic-programming technique developed at The RAND Corporation is applied to the solution of the airplane minimum time-to-climb problem. A brief introduction to dynamic programming is presented, followed by an exposition of the climb problem and the solution of a typical example case. It is concluded that dynamic programming offers a method of solution for the climb problem which is fast, is readily adaptable to routine engineering calculation, and allows the inclusion of the effects of variations in airplane weight and drag along the flight path. (Author)

AD-605 021 Div. 15, 32
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
MULTI-DIMENSIONAL MAXIMIZATION, DYNAMIC PROGRAMMING AND ECONOMIC LOT SIZE,
by Richard Bellman. 3 Apr 56, 22p P-837
Unclassified report

Descriptors: (*Dynamic programming, Economics), (*Economics, Dynamic programming), Functions, Equations, Digital computers, Stochastic processes, Sequences, Distribution (Economics).

It is shown that some problems arising in the determination of economic lot size lead to the analytic problem of determining the maximum of a certain function subject to a number of constraints. These problems are reduced to the determination of a sequence of functions via the functional equation approach of the theory of dynamic programming.

AD-605 026 Div. 15, 30
OTS Prices: HC $3.00/MF $0.75

RAND Corp., Santa Monica, Calif.
MANUAL FOR THE RAND-IBM CODE FOR LINEAR PROGRAMMING ON THE 704,
by William Orchard-Hays, Leola Cutler, and Harold Judd. 16 May 56, 62p P-842 Unclassified report

Legibility of this document is in part unsatisfactory. Reproduction has been made from best available copy.

Descriptors: (*Linear programming, Digital computers), (*Programming (Computers), Linear programming), (*Digital computers, Linear programming), Compilers, Matrix algebra, Numerical methods and procedures, Instruction manuals.

A linear programming system which is the modified simplex procedure with the product form of inverse is discussed. It is designed to solve the classical linear inequalities problem and most of its variations on the IBM 704. (Author)

AD-605 029 Div. 15, 32
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
NOTES ON THE THEORY OF DYNAMIC PROGRAMMING; VIII,
by Richard Bellman. 18 Apr 56, 6p P-845
Unclassified report

Descriptors: (*Dynamic programming, Economics), Calculus of variations, Industrial production, Numerical analysis, Numerical methods and procedures, Theory.

A problem in the study of production smoothing leads to the problem of minimizing a linear form subject to certain constraints. A computational solution of this problem is given, using the methods of dynamic programming.

AD-605 030 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
PRIORITY ASSIGNMENT ON A WAITING LINE,
by S. A. Dressin and E. Reich. 19 Apr 56, 8p P-846
Unclassified report

Descriptors: (*Queueing theory, Statistical processes), Probability, Scheduling, Model theory, Mathematical models, Differential equations, Time studies, Statistical functions, Operations research.

AD-605 039 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
FUNCTIONAL EQUATIONS IN THE THEORY OF DYNAMIC PROGRAMMING VII: AN INTEGRO-DIFFERENTIAL EQUATION FOR THE FREDHOLM RESOLVENT,
by Richard Bellman. 7 May 56, 10p P-859
Unclassified report

Descriptors: (*Dynamic programming, Equations), (*Equations, Dynamic programming), (*Integral equations, Dynamic programming), Differential equations, Calculus of variations, Functional analysis.

AD-605 041 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
INFORMATION IN GAMES WITH FINITE RESOURCES,
by David Gale. 7 May 56, 10p P-861
Unclassified report

AD-604 976 Div. 15, 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
EIGENVALUES AND FUNCTIONAL EQUATIONS,
by Richard Bellman. 28 Dec 55, 10p P-784
Unclassified report

Descriptors: (*Equations, Dynamic programming), (*Dynamic programming, Theory), (*Calculus of variations, Sequences), Optimization, Matrix algebra, Functions, Polynomials, Number theory.

The purpose of this paper was to illustrate how the techniques of the theory of dynamic programming may be used to convert a number of eigenvalue problems, where one is interested only in maximum or minimum values, into problems involving recurrence relations. Treated Jacobi matrices, some special types of quadratic forms possessing certain features of regularity, and finally Sturm-Liouville problems. The method discussed is not only useful for computational purposes, but provides a method for studying the analytic dependence of the maximum and minimum eigenvalues upon the analytic structure of the matrix.

AD-604 978 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ON SCHLIGHT FUNCTIONS WITH REAL COEFFICIENTS,
by Edgar Reich. 30 Dec 55, 12p P-786
Unclassified report

Descriptors: (*Functions, Real numbers), (*Real numbers, Functions), (*Complex numbers, Functions), Theorems, Potential theory, Conformal mapping, Differential equations, Topology, Set theory.

AD-604 979 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
DYNAMIC PROGRAMMING,
by Richard Bellman. 3 Jan 56, 6p P-787
Unclassified report

Prepared for publication in SIAM Newsletter.

Descriptors: (*Dynamic programming, Decision theory), (*Decision theory, Dynamic programming), Theory, Calculus of variations.

This is a brief description of decision processes in dynamic programming.

AD-605 001 Div. 15
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
GAMES WITH PARTIAL INFORMATION,
by H. E. Scarf and L. S. Shapley. Rev. 13 Apr 56, 28p P-797
Unclassified report

Descriptors: (*Game theory, Decision theory), Equations, Functions, Military strategy, Optimization.

Consideration is given to a particular class of games with partial information. Generalized subgames are defined. These subgames give rise to functional equations whose solution permits a recursive construction of the optimal strategies. (Author)

AD-605 005 Div. 15, 30
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ON THE APPLICATION OF THE THEORY OF DYNAMIC PROGRAMMING TO THE STUDY OF CONTROL PROCESSES,
by Richard Bellman. 24 Feb 56, 24p P-807
Unclassified report

Descriptors: (*Control, Dynamic programming), (*Dynamic programming, Theory), (*Equations, Dynamic programming), Servomechanisms, Electrical engineering, Mechanical engineering, Economics, Industrial production, Calculus of variations, Stochastic processes, Control systems, Vector analysis.

In this paper the authors indicate the application of the functional equation technique of dynamic programming to the study of some typical control processes arising in the study of electrical and mechanical systems. (Author)

AD-605 012 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ON EXPLICIT SOLUTIONS OF SOME TRINOMIAL EQUATIONS IN TERMS OF THE MAXIMUM OPERATION,
by Richard Bellman. 14 Mar 56, 8p P-821
Unclassified report

Descriptors: (*Numerical analysis, Equations), (*Equations, Polynomials), (*Nonlinear programming, Equations), Functions, Convex sets, Calculus of variations, Mathematical programming, Iterative methods.

In this paper it is shown that the nonnegative solutions of trinomial equations of the form phi (x) + ax = b may be expressed in terms of the maximum or minimum of explicit functions, provided that phi (x) is strictly convex or strictly concave. (Author)

AD-605 014 Div. 15, 33
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ON THE MAX FLOW MIN CUT THEOREM OF NETWORKS,
by G. B. Dantzig and D. R. Fulkerson.
15 Apr 55, 14p P-826
Unclassified report

Descriptors: (*Networks, Theorems), (*Linear programming, Networks), (*Traffic theorems), Transportation, Distribution theory, Inequalities, Statistical analysis.

It is shown that Menger's theorem and the Max Flow Min Cut Theorem on networks are applications of the duality theorem of linear inequality theory. (Author)

AD-605 015 Div. 15, 26, 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A PRIMAL DUAL ALGORITHM FOR THE CAPACITATED HITCHCOCK PROBLEM,
by L. R. Ford, Jr. and D. R. Fulkerson.
Rev. 25 Sep 56, 16p P-827 Unclassified report

Descriptors: (*Topology, Game theory), (*Game theory, Set theory), (*Set theory, Game theory), Optimization, Functions.

An n-person game solution is constructed around an arbitrary closed set, showing that there is practically no limit to the possible complexity of solutions. (Author)

AD-605 057 Div. 15, 32
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE CENTRAL MATHEMATICAL PROBLEM,
by G. B. Dantzig. 9 Jul 56, 22p P-892
Unclassified report

Descriptors: (*Linear programming, Mathematical models), (*Economics, Linear programming), Inequalities, Optimization, Transformations (Mathematics).

Symbols are introduced to distinguish various activities, items, the assumed constant flows and costs (or profits) per unit level of activity, the activity levels and the quantities of demand or availability of various items. The central problem is then stated in standard algebraic form. It is shown that the problem of minimizing a linear form where the unknowns satisfy a system of equations in non-negative variables is equivalent to one where the variables satisfy a system of linear inequalities. It is stated without proof that an optimizing solution belongs to a class of feasible solutions that 'involve' no more variables than equations. The simplex method is illustrated by showing for this class a way of testing the optimality of a solution and constructing a sequence of improved feasible solutions. (Author)

AD-605 058 Div. 15, 4, 10
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
FORMULATING A LINEAR PROGRAMMING MODEL,
by G. B. Dantzig. 9 Jul 56, 22p P-893
Unclassified report

Descriptors: (*Linear programming, Mathematical models), (*Mathematical models, Linear programming), (*Refineries, Linear programming), Theory, Petroleum industry.

A simplified oil refinery example is used to illustrate the principles of building a linear programming model. (Author)

AD-605 065 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ON A CLASS OF FUNCTIONAL EQUATIONS OF MODULAR TYPE,
by Richard Bellman. 16 Jul 56, 10p P-903
Unclassified report

Descriptors: (*Number theory, Equations), (*Functions, Equations), Algebra, Bessel functions.

The purpose of the paper is to show how the Voronoi functions and their analogues in algebraic number fields, matric fields, and finite fields, can be used to generate large classes of functions possessing functional equations of modular type. (Author)

AD-605 070 Div. 15
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE REVISED SIMPLEX METHOD,
by William Orchard-Hayes. 6 Aug 56, 30p P-911
Unclassified report

Descriptors: (*Linear programming, Matrix algebra), (*Matrix algebra, Linear programming), Optimization, Equations, Algebra, Transformations (Mathematics), Iterative methods, Mathematical programming.

A revision of the simplex method is presented which makes explicit use of columns of the restraint coefficients associated with a basic set of variables. The development is based on the single assumption of linearly independent restraint equations. An algebraic method of resolving degeneracy is given in conclusion. (Author)

AD-605 073 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE COMPLETE DUALIZED SYSTEM OF THE SIMPLEX METHOD,
by William Orchard-Hays. 9 Aug 56, 16p P-916
Unclassified report

Descriptors: (*Linear programming, Matrix algebra), (*Matrix algebra, Linear programming), Optimization, Mathematical programming, Iterative methods, Calculus of variations, Numerical analysis.

The augmented tableau of the revised simplex method is further augmented to display all relationships involved. The simplex method is applied to the dual system to solve the primal system starting from a solution which is feasible for the dual. (Author)

AD-605 074 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ON THE APPLICATIONS OF DYNAMIC PROGRAMMING TO MATRIX THEORY,
by Richard Bellman. Rev. 21 Nov 56, 12p P-917
Unclassified report

Descriptors: (*Dynamic programming, Matrix algebra), (*Matrix algebra, Dynamic programming), Functions, Equations, Digital computers, Sequences.

The purpose of the paper is to discuss some applications of the functional equation technique of dynamic programming to some questions of matrix theory. Consideration is first given to the solution of a system of linear equations, $Ax = b$, where A is a Jacobi matrix. Then the same problem is discussed for the case where A is 'almost' a block-diagonal matrix. Matrices of this type arise in the study of weakly-coupled mechanical or electrical systems. Finally, the calculation of the largest or smallest characteristic values of matrices of this type are discussed. (Author)

AD-605 075 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
NOTES ON MATRIX THEORY---XIII: SLIGHTLY INTERTWINED LINEAR PROGRAMMING MATRICES,
by Richard Bellman. Rev. 23 Jan 57, 6p P-918
Unclassified report

Descriptors: (*Game theory, Optimization), Matrix algebra, Probability, Permutations, Numbers, Mathematical prediction, Warfare, Military strategy.

A game with finite resources is, roughly speaking, a game in which each player is required to play each pure strategy a fixed number of times, but in any order. It is shown that in such games the uniform mixed strategy is optimal, and therefore it is of no help to a player to know which strategies are available to his opponent. (Author)

AD-605 042 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
BIRTH-DEATH PROCESSES AND TANDEM QUEUES,
by E. Reich. 22 Jun 56, 6p P-863
Unclassified report

Descriptors: (*Statistical processes, Queueing theory), (Queueing theory, Statistical processes), Probability, Matrix algebra, Stochastic processes, Population (Mathematics).

This work points out a simple property of stationary birth and death processes, which implies that for certain queues, the output process is closely related to the input process. This is applied to a situation where customers proceed to a second queue after having been processed at a first queue.

AD-605 043 Div. 15, 18, 32
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ON A DYNAMIC PROGRAMMING APPROACH TO THE CATERER PROBLEM I,
by Richard Bellman. 17 May 56, 20p P-866
Unclassified report

Descriptors: (*Dynamic programming, Scheduling), (*Scheduling, Dynamic programming), Calculus of variations, Economics, Logistics, Equations, Numerical methods and procedures.

In this paper, it is shown that the 'caterer' problem, a problem in mathematical economics and logistics which has been discussed by Jacobs, Gaddum, Hoffman and Sokolowsky, and Prager, can be reduced to the problem of determining the maximum of a linear form subject to a series of constraints. This maximization problem is solved explicitly, using the functional equation technique of dynamic programming.

AD-605 044 Div. 15, 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
DYNAMIC PROGRAMMING AND LAGRANGE MULTIPLIERS,
by Richard Bellman. 21 May 56, 8p P-869
Unclassified report

Descriptors: (*Dynamic programming, Numerical analysis), (*Numerical analysis, Partial differential equations), (*Partial differential equations, Dynamic programming), Calculus of variations, Sequences, Functions, Equations, Numerical methods and procedures.

In this paper it is shown that a combination of the classical Lagrange multiplier formalism and the functional equation technique of dynamic programming enables a number of types of variational problems involving the computation and tabulation of functions of M variables to be treated by computing first sequences of functions of K variables, and then sequences of functions of M--K variables, where K may be chosen within the range 1 < or = K < or = M-1. The choice of K depends upon the process This reduction in the dimensionality of the functions involved is equivalent to an increase in the capability of modern digital computers as far as dynamic programming processes are concerned. (Author)

AD-605 048 Div. 15
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
DISCRETE-VARIABLE EXTREMUM PROBLEMS,
by George B. Dantzig. Rev. 12 Dec 56, 26p P-876
Unclassified report

Descriptors: (*Linear programming, Complex variables), (*Complex variables, Linear programming), (*Dynamic programming, Scheduling), Optimization, Combinatorial analysis, Numerical analysis, Calculus of variations, Mathematical programming.

This paper reviews some recent successes in the use of linear programming methods for the solution of discrete-variable extremum problems. One example of the use of the multistage approach of dynamic programming for this purpose is also discussed. (Author)

AD-605 049 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
SOLUTION OF A RANKING PROBLEM FROM BINARY COMPARISONS,
by L. R. Ford, Jr. Rev. 7 Jun 56, 16p P-877
Unclassified report

Descriptors: (*Statistical analysis, Iterative methods), Binary arithmetic, Matrix algebra, Equations, Probability, Series, Decision making, Game theory.

AD-605 053 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A COMPARISON OF LINEAR PROGRAMMING AND DYNAMIC PROGRAMMING,
by Stuart E. Dreyfus. 22 Jun 56, 16p P-885
Unclassified report

Descriptors: (*Linear programming, Dynamic programming), (*Dynamic programming, Linear programming), Correlation techniques, Mathematical programming, Numerical methods and procedures.

This paper considers the applications and interrelations of linear and dynamic programming and attempts to place each in a proper perspective so that efficient use can be made of the two techniques. (Author)

AD-605 055 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A SOLUTION CONTAINING AN ARBITRARY CLOSED COMPONENT,
by Lloyd S. Shapley. 3 Jul 56, 12p P-888
Unclassified report

ON POSITIVE DEFINITE MATRICES AND STIELTJES INTEGRALS,
by Richard Bellman. 22 Oct 56, 10p P-947
Unclassified report

Descriptors: (*Matrix algebra, Integrals), (*Integrals, Matrix algebra), Functions, Complex numbers, Sequences, Inequalities, Probability, Transformations (Mathematics).

AD-605 098 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A UNIFIED PROCESS FOR THE EVALUATION OF THE ZEROS OF POLYNOMIALS OVER THE COMPLEX NUMBER FIELD,
by John I. Derr. Rev. 30 Apr 58, 20p P-948
Unclassified report

Descriptors: (*Polynomials, Number theory), (*Complex numbers, Functions), (*Iterative methods, Polynomials), Numerical analysis, Equations.

A Polynomial equation f (z) = 0 in a complex variable z, where f (z) has complex coefficients is considered. Use is made of Newton's method for the evaluation of the zeros of the analytic function generalized by the conventional recurrence relation to solve the equation.

AD-605 099 Div. 15, 8
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ON THE ROLE OF DYNAMIC PROGRAMMING IN STATISTICAL COMMUNICATION THEORY,
by Richard Bellman and Robert Kalaba.
Rev. 19 Dec 56, 22p P-949
Unclassified report

Descriptors: (*Communication theory, Dynamic programming), (*Dynamic programming, Statistical analysis), Stochastic processes, Communication systems, Distribution theory, Decision theory, Signals, Functions, Sequences.

The object of the paper is to show that the fundamental problem of determining the utility of a communication channel in conveying information can be interpreted as a problem within the framework of multi-stage decision processes of stochastic type and as such may be treated by means of the theory of dynamic programming. (Author)

AD-605 100 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
LINEAR PROGRAMMING,
by Robert E. Kalaba. 1 Oct 56, 18p P-950
Unclassified report

Descriptors: (*Linear programming, Theory), Game theory, Analysis of variance, Scheduling, Equations, Geometry, Communication systems, Transportation, Nutrition.

Topics include: examples of linear programming problems, the central mathematical problem, methods of solution, and lines along which further research is required. (Author)

AD-605 103 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ON THE LINEAR DIFFERENTIAL EQUATION WHOSE SOLUTIONS ARE THE PRODUCTS OF SOLUTIONS OF TWO GIVEN LINEAR DIFFERENTIAL EQUATIONS,
by Richard Bellman. 10 Oct 56, 8p P-956
Unclassified report

Descriptors: (*Differential equations, Matrix algebra), (*Matrix algebra, Differential equations), Special functions (Mathematical), Power series, Equations.

The purpose of the paper is to illustrate the application of a result in matrix theory to the problem of determining the linear differential equation whose solutions are the products of the solutions of two given linear differential equations. (Author)

AD-605 108 Div. 15, 33
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
CONSTRUCTING MAXIMAL DYNAMIC FLOWS FROM STATIC FLOWS,
by L. R. Ford, Jr. and D. R. Fulkerson.
Rev. 17 Sep 57, 32p P-967
Unclassified report

Descriptors: (*Linear programming, Networks), (*Networks, Statistical analysis), (*Railroads, Linear programming), Transportation, Optimization, Statics, Dynamics, Iterative methods, Theorems.

For a given network of nodes and arcs, such as a railway system, in which it is assumed that each arc has associated with it two positive integers -- one a commodity-flow capacity, the other a commodity-traversal time -- a method of constructing maximal dynamic flow from static flow is outlined and a simple proof of maximality is presented. (Author)

AD-605 116 Div. 15, 26
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
CONCEPTS, ORIGINS, AND USE OF LINEAR PROGRAMMING,
by George B. Dantzig. 7 Mar 57, 20p P-980
Unclassified report

Descriptors: (*Linear programming, Mathematical models), (*Mathematical models, Linear programming), History, Background, Optimization, Scheduling, Analysis, Economics.

This paper discusses the concept, origins, and some of the applications of linear programming. (Author)

AD-605 117 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
BOUNDS ON THE EXPECTATION OF A CONVEX FUNCTION OF A RANDOM VARIABLE,
by H. P. Edmundson. 26 Nov 56, rev. 9 Apr 57,
6p P-982
Unclassified report

Descriptors: (*Functions, Analysis of variance), Set theory, Moments, Inequalities, Theorems.

Suppose that f is a convex function defined on the interval I = (a, b) where b>a. Let X be a random variable defined on I whose expectation E(X) is finite. Upper and lower bounds for the expectation E(f(X)) are derived using the theory of moment spaces. The lower bound obtained

Descriptors: (*Linear programming, Matrix algebra), (*Matrix algebra, Linear programming), Dynamic programming, Functions, Equations, Numerical methods and procedures.

In this paper the functional--equation approach of dynamic programming is used to treat a linear programming problem involving a 'slightly intertwined' matrix--i.e., one that is almost block diagonal. (Author)

AD-605 077 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
UPPER BOUNDED VARIABLES IN LINEAR PROGRAMMING,
by George B. Dantzig and S. M. Johnson. Rev. 24 Apr 57, 14p P-921
Unclassified report

Descriptors: (*Linear programming, Matrix algebra), (*Matrix algebra, Linear programming), Equations, Functions, Nufnerical methods and procedures.

The purpose of the paper is to develop short-cut computational methods for solving an important class of systems involving upper bound restraints on the variables.

AD-605 079 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
COMPUTATIONAL ASPECTS OF DYNAMIC PROGRAMMING,
by Stuart E. Dreyfus. 19 Nov 56, 14p P-924
Unclassified report

Presented at a meeting of the Operations Research Society of America, San Francisco, Calif., 15 Nov 56.

Descriptors: (*Dynamic programming, Numerical methods and procedures), (*Numerical methods and procedures, Dynamic programming), Numerical analysis, Theory, Calculus of variations.

Several computational difficulties are characteristic of all dynamic programming solutions. This paper will attempt to isolate the most important of these difficulties, to examine present techniques, and to suggest areas in which further developments are required. (Author)

AD-605 082 Div. 15, 32
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
GRADIENT METHODS FOR CONSTRAINED MAXIMA,
by K. J. Arrow and L. Hurwicz. 28 Aug 56, 14p P-928
Unclassified report

Partly supported by the Office of Naval Research and the Cowles Commission for Research in Economics.

Descriptors: (*Calculus of variations, Numerical methods and procedures), (*Numerical methods and procedures, Calculus of variations), Game theory, Differential equations, Optimization, Mathematical programming, Economics.

AD-605 086 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
SEQUENTIAL MINIMAX SEARCH FOR A ZERO OF A CONVEX FUNCTION,
by O. Gross and S. M. Johnson. 11 Sep 56, 24p P-935
Unclassified report

Descriptors: (*Game theory, Sequences), (*Functions, Mathematical analysis), Search theory, Equations, Graphics, Digital computers.

Given: a positive and a negative value of a function at two given points respectively. The function is continuous and convex and is otherwise unknown but computable. Starting with this information, a procedure is described for locating its unique root (on the starting interval) within an interval of minimum guaranteeable length in n steps, where a step consists of calculating the value of the function at any point we choose. The pertinent functional equation is derived and curves of the objective function are plotted for n = 1, 2, 3, 4 from data obtained from the Johniac, RAND'S Princeton-type high-speed digital computer. (Author)

AD-605 089 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ON THE EXPANSIONS OF SOME INFINITE PRODUCTS,
by Richard Bellman. 14 Sep 56, 8p P-938
Unclassified report

Descriptors: (*Identities, Series), (*Series, Identities), Equations, Functions, Mathematical logic.

AD-605 090 Div. 15
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A SYSTEMATIC APPROACH TO A CLASS OF PROBLEMS IN THE THEORY OF NOISE AND OTHER RANDOM PHENOMENA. III. EXAMPLES,
by A. J. F. Siegert. 17 Sep 56, 40p P-939
Unclassified report

Descriptors: (*Noise, Theory), (*Statistical processes, Noise), Linear differential equations, Integral equations, Functions, Equations, Mathematical analysis, Probability.

AD-605 092 Div. 15, 26
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A FEASIBILITY ALGORITHM FOR ONE-WAY SUBSTITUTION IN PROCESS ANALYSIS,
by Kenneth J. Arrow and Selmer M. Johnson. Rev. 12 Sep 57, 10p P-941
Unclassified report

Descriptors: (*Systems engineering, Machines), (*Operations research, Optimization), Linear programming, Distribution, Analysis, Feasibility studies.

A certain number of machines are available, not all of the same capability, with which to do a certain number of tasks, varying in difficulty. On the assumption that it is better to use a more capable machine for a more difficult task, an algorithm is given for the most efficient assignment of machines to tasks. It is shown that the algorithm solves an equivalent linear programming problem. (Author)

AD-605 097 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.

16. Medical Sciences

AD-604 369 Div. 16, 25
OTS Prices: HC $9.35/MF $2.75

Adaptronics, Inc., Alexandria, Va.
A COMPILATION OF BIOLOGICAL LAWS, EFFECTS, AND PHENOMENA, WITH ASSOCIATED PHYSICAL ANALOGS.
Final rept.,
by L. O. Gilstrap, Jr., J. S. McNeil, L. P. Greenberg, and R. B. Spodak. Jun 64, 631p
Contract AF33 657 7099, Proj. 4160, Task 416001
Unclassified report

Descriptors: (*Biophysics, Analog systems), Biology, Physics, Behavior, Animals, Humans, Insects, Hormones, Food, Bites and stings, Sensory perception, Electric currents, Nerve cells, Muscles, Learning, Luminescence, Vision, Movement, Flight, Regeneration, Growth, Automata, Hearing, Genetics, Feedback, Stabilization systems, Conditioned reflex, Neuromuscular transmission, Sound ranging, Bionics, Physiology.

A compilation of biological laws, effects and phenomena and their associated physical analogs is presented. Information on each law, effect or phenomenon is contained in separate entries which are grouped roughly into sections by similarity of content. Entries are cross referenced by animals and plants mentioned in each entry, by sample physical devices, systems, effects or phenomena analogous to the described biological law, effect or phenomenon in each entry, and by physical class (i.e., by the branch of physical science most relevant to the biological description) and by physical operator (i.e., by the categories of sensor, transformer, or actuator, whichever is more nearly descriptive of the entry). (Author)

AD-604 411 Div. 16
OTS Prices: HC $1.00/MF $0.50

Wisconsin Univ., Madison.
ORIENTATION OF FISHES.
Final rept. for 1 Sep 57-30 Aug 63,
by Arthur D. Hasler. May 63, 16p
Contract Nonr1202 04, Proj. NR301 903
Unclassified report

Descriptors: (*Fishes, Direction finding), (*Sensory perception, Fishes), Echo ranging, Underwater sound, Underwater sound equipment, Sound transmission, Environmental tests, Diurnal variations, Behavior, Sun, Illumination, Adaptation (Physiology), Homing devices, Lakes, Wisconsin.

The over-all objective was the exploration of the cues used by fishes in accomplishing local or long distance movements and was an outgrowth of an earlier study in which it was shown that fishes could make their way through a stream system in response to a 'home' odor. Further studies were needed to provide information on orientation in 'open' water where odors must necessarily play a lesser role. The elucidation of orienting mechanisms requires both (a) laboratory study of sensory capabilities through electrophysiological and conditioning (training) techniques, and (b) field study of natural and induced movements as related to the environmental conditions under which these movements occur. Together, such studies pave the way for (c) 'experiments in the field' in which the guiding cues are experimentally manipulated by sensory deprivation or environmental modification. (Author)

AD-604 464 Div. 16
OTS Prices: HC $1.00/MF $0.50

Florida Univ., Gainesville. Coll. of Medicine.
MEASUREMENT OF AIRWAY RESISTANCE WITH A VOLUME DISPLACEMENT BODY PLETHYSMOGRAPH,
by M. J. Jaeger and A. B. Otis. Jun 64, 18p
Contracts AF41 657 102, AF41 609 1553, Proj. 7758, Task 775801
SAM TDR64 17
Unclassified report

Descriptors: (*Respiration, Measurement), (*Pressure breathing, Measurement), Tissues (Biology), Lungs, Gases, Carbon dioxide, Oxygen, Body temperature, Pressure, Viscosity, Medical equipment, Equations, Correlation techniques, Medical equipment.

Airway resistance was measured with a volume displacement body plethysmograph in 40 normal subjects breathing at their spontaneous breathing rate. The measurements are based on a method designed by DuBois et al., which was modified in order to extend its applicability. The subjects were rebreathing from a bag containing gas at approximately BTPS conditions. Possible errors in conditioning the gas in the bag were corrected mathematically. The values of airway resistance obtained (1.26± 0.39 cm. H2O per liter per second) agree with those published by DuBois et al. and by other authors using the same technic. The measurements were found to correlate with results obtained on the same subjects with related technics. The paper also includes measurements of lung-tissue viscous resistance and inertance of the gas in the airways. (Author)

AD-604 465 Div. 16
OTS Prices: HC $1.00/MF $0.50

Ohio State Univ., Columbus. Research Foundation.
CATHETER-TIP FLOWMETER FOR THE MEASUREMENT OF CORONARY ARTERIAL BLOOD FLOW IN INTACT ANESTHETIZED DOGS,
by Heinz P. Pieper. Jun 64, 17p
Contract AF41 609 1454, Proj. 7758, Task 775801
SAM TDR64 33
Unclassified report

Descriptors: (*Blood circulation, Flowmeters), (*Flowmeters, Blood circulation), Cannulation, Arteries, Heart, Aorta, Cardiovascular system, Blood pressure, Medical equipment, Test methods, Surgical techniques, Dogs.

A catheter-tip flowmeter has been designed for the measurement of coronary arterial blood flow in closed-chest dogs. The miniaturized flowmeter is attached to the tip of a rigid catheter, which is inserted through the right carotid artery. The flowmeter is placed in the ascending aorta where it measures the inflow into the left coronary artery. Performance tests show the reliability of the instrument for the measurement of pulsatile flow. The flowmeter has been applied to determine the pressure-flow relationship of the coronary system of closed-chest anesthetized dogs. This pressure-flow relationship is obtained over the pressure range of greatest physiologic importance and describes the system for a constant set of cardiovascular conditions. (Author)

AD-604 469 Div. 16
OTS Prices: HC $1.00/MF $0.50

Johns Hopkins Univ., Baltimore, Md.
FINAL TECHNICAL REPORT. [STUDY OF THE CENTRAL NERVOUS SYSTEM OF PRIMATES IN THE UNANESTHETIZED STATE].

agrees with that of classical analysis, while the upper bound is believed to be a new result. (Author)

AD-605 122 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
NETWORK FLOW AND SYSTEMS OF REPRESENTATIVES,
by L. R. Ford, Jr. and D. R. Fulkerson.
11 Dec 56, 16p P-990
Unclassified report

Descriptors: (*Linear programming, Networks), (*Networks, Statistical analysis), (*Set theory, Linear programming), Combinatorial analysis, Integrals, Theorems.

Two basic theorems of network flow theory are applied to determine necessary and sufficient conditions for (a) the existence of a system of representatives for a collection of subsets of a given set such that each element, a sub i of the given set occurs at least alpha sub i times in the system and at most beta sub i times (a system of restricted representatives), and (b) the existence of a common system of restricted representatives for two different collections of subsets of the given set. (Author)

AD-605 125 Div. 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THEORY OF GAMES OF STRATEGY,
by Melvin Dresher. 17 Dec 56, 16p P-994
Unclassified report

Descriptors: (*Game theory, Probability), Functional analysis, Mathematical models, Distribution, Decision theory, Military strategy.

The paper contains a general survey of the mathematical theory of zero-sum two-person games. (Author)

AD-605 126 Div. 15
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
QUEUEING WITH BALKING,
by Frank A. Haight. 18 Dec 56, 26p P-995
Unclassified report

Descriptors: (*Queueing theory, Stochastic processes), (*Stochastic processes, Queueing theory), Probability, Differential equations, Statistical distributions.

An investigation of a stochastic process in which the probability of transition depends on the state of the system. (Author)

AD-604 524 Div. 16
OTS Prices: HC $1.00/MF $0.50

Army Medical Research and Nutrition Lab., Denver, Colo.
SUMMARY OF SIGNIFICANT FINDINGS BY SGO IRRADIATED FOOD CONTRACTORS.
Rept. for Sep 63-Mar 64,
by Nicholas Raica, Jr., and Howerde E. Sauberlich.
Aug 64, 3p

Unclassified report

Descriptors: (*Abstracts, Irradiated foods), (*Irradiated foods, Radiation effects), Radiation hazards, Rats, Dogs, Pathology, Food.

A summary of radiation effects on rats and dogs after the consumption of irradiated foods is presented.

AD-604 525 Div. 16, 10
OTS Prices: HC $1.00/MF $0.50

Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
PATHOLOGY AND TOXICOLOGY OF REPEATED DOSES OF HYDRAZINE AND 1, 1-DIMETHYLHYDRAZINE IN MONKEYS AND RATS,
by Roman L. Patrick and Kenneth C. Back.
Jun 64, 19p
Proj. 6302, Tasks 630201, 630206
AMRL TDR64 43

Unclassified report

Descriptors: (*Toxic tolerances, Hydrazine), (*Hydrazine, Toxic tolerances), (*Dimethyl hydrazine (1-1), Toxic tolerances), Rocket propellants, Fuels, Pathology, Dosage, Necrosis, Liver, Kidneys, Muscles, Heart, Glucose, Lipids, Bile pigments, Monkeys, Rats.

Twelve rhesus monkeys received daily doses of hydrazine ranging from 5 to 20 mg/kg and totaling from 4 to 20 injections. Seven monkeys received 20 injections of 1, 1-dimethylhydrazine at 10 mg/kg. All animals lost weight during the experiment. In the hydrazine-treated group of monkeys, serum glutamic oxaloacetic transaminase and bilirubin rose with doses of 20 mg/kg, with more than a twentyfold increase of SGOT in two animals. Most of those receiving 20 mg/kg exhibited loss of appetite, vomiting, lethargy, and severe weakness. Microscopic examination revealed lipid accumulation in the liver, myocardium, kidney, and skeletal muscle. Massive liver necrosis was observed in one animal. In those monkeys receiving UDMH, blood glucose rose significantly toward the end of the experiment. Some lipid was deposited in the heart, liver, and kidney, but to a much lesser degree than was observed with hydrazine, and it could only be demonstrated with special fat stain. Rats given from 3 to 23 doses of 10 or 20 mg/kg/day hydrazine did not show marked fatty changes as observed in the monkeys. (Author)

AD-604 528 Div. 16, 12
OTS Prices: HC $1.00/MF $0.50

Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
OXYGEN-NITROGEN INDICATOR-CONTROLLER AND SPACE CABIN OUTBOARD LEAK SIMULATOR.
Rept. for Sep 62-Sep 63,
by W. F. Mickelson and W. D. Hypes. Jun 64, 19p
Proj. 6373, Task 637305
AMRL TDR64 25

Unclassified report

Descriptors: (*Respiration, Astronauts), (*Closed ecological systems, Respiration), (*Pressure regulators, Spacecraft cabins), Oxygen, Nitrogen, Space environmental conditions, Life support, Space medicine, Pressurized cabins, Manned, Adaptation (Physiology), Control systems, Barometric pressure, Models (Simulations).

The evaluation of a compact electrical-mechanical device for controlling the oxygen-nitrogen concentration of the atmosphere within an aerospace vehicle cabin simulator during a 2-man, 3-day test is described. Also described is a device used during the evaluation to program various rates of leakage of the atmosphere from the simulator so the response of the controller could be checked periodically. Data obtained reveal a capability for automatically controlling the oxygen-filler gas concentration in an aerospace vehicle cabin simulator over varying ranges of total cabin pressures. (Author)

AD-604 567 Div. 16, 30
OTS Prices: HC $1.00/MF $0.50

Naval School of Aviation Medicine, Pensacola, Fla.
AN INSTRUMENT FOR ELECTROCARDIOGRAPHIC AREA MEASUREMENTS.
Research rept.
by Thomas G. Arnold, Jr. and Raphael F. Smith.
26 May 64, 23p
Proj. MR005 13 7004, Task 8
NSAM RR1

Unclassified report

Descriptors: (*Analog computers, Electrocardiography), (*Electrocardiography, Analog computers), Medical equipment, Heart, Exercise, Deflection.

An instrument which was developed to measure the area of electrocardiographic deflections is described. Basically, the instrument is a special purpose analog computer that performs the mathematical operation of integration on three input signals. Synchronizing circuits have been added to start the period of integration at a predetermined time in the cardiac cycle. This instrument is an essential component in a system used to quantitate the ECG changes that occur after exercise. (Author)

AD-604 596 Div. 16, 12.
OTS Prices: HC $1.00/MF $0.50

Naval School of Aviation Medicine, Pensacola, Fla.
THE EFFECTS OF CORIOLIS ACCELERATION DURING ZERO GRAVITY FLIGHT ON CERTAIN HEMATOLOGICAL AND URINARY PARAMETERS IN NORMAL AND LABYRINTHINE DEFECTIVE SUBJECTS.
Joint research rept. no. 2,
by James K. Colehour. 19 May 64, 19p
Proj. MR005 13 0004, NASA Order R93

Unclassified report

Research sponsored by Office of Life Science Programs, National Aeronautics and Space Administration.

Descriptors: (*Deafness, Acceleration), (*Coriolis effect, Vestibular apparatus), (*Acceleration, Hematology), (*Vestibular apparatus, Acceleration), Urine, Blood analysis, Leukocytes, Space medicine, Stress (Physiology), Thalamus, Pituitary gland, Adrenal glands, Corticosteroid agents, Gravity, Tolerances (Physiology), Glycolysis, Amines, Lactic acid, Statistical analysis, Space environmental conditions.

When normal subjects were exposed to repetitive, zero gravity, parabolic flight, significant increases in neutrophils, eosinophils, and urinary 17-hydroxycorticosteroids

1963, 8p
Grant AF AFOSR62 31
AFOSR 64 1435

Unclassified report

Descriptors: (*Central nervous system, Primates), (*Primates, Central nervous system), Anesthesia, Nerve cells, Thalamus, Cerebral cortex, Sensation (Physiology), Stimulation, Performance (Human), Reflexes, Nerve impulses, Surgery, Pain, Thresholds (Physiology), Neuromuscular transmission, Stochastic processes, Decision theory, Monkeys.

A preparation was devised which allowed study of the central nervous system of primates in the unanesthetized state, without provocation of pain, using the method of single unit analysis. Studies were made of the neurons of the ventrobasal nuclear complex, the thalamocortical input stage of the somatic afferent system. The highly specific nature of the lemniscal system in terms of place and quality were found to be as certain and precise in the waking animal as they had previously been found to be in the anesthetized one. The temporal capacity of the lemniscal system was found to be greater in the former state than the later by an entire order of magnitude. A quantitative study was made of the relation between thalamic cell response and the driving peripheral stimulus, as the latter is varied along an intensive continuum. This relation is adequately described by a power function of the form: $R = KS^{(n)}$, with an exponent of 0.6-0.7. The relation of this finding to similar functions governing human performance in the stimulus-response situation were explored.

AD-604 470 Div. 16
OTS Prices: HC $1.00/MF $0.50

Instituto de Ciencias Biologicas, Montevideo (Uruguay).
ANNUAL (FINAL) REPORT. [NEUROBIOLOGY, CELL ULTRASTRUCTURE, BIOPHYSICS AND ELECTROPHYIOLOGY],
by J. Sas, C. Appeltauer, C. Estable, E. Silva, and O. Vincent. 1964, 10p
Grant AF AFOSR63 313
AFOSR 64 1434

Unclassified report

Descriptors: (*Neurology, Reports), (*Reports, Neurology), (*Biophysics, Reports), Muscles, Eye, Humans, Reflexes, Respiratory system, Nerves, Neuromuscular transmission, Autonomic nervous system, Stimulation, Nerve fibers, Embryology, Growth, Embryonated egg technique, Regeneration, Labeled substances, Radioactive isotopes, Proteins, Amino acids, Lipids, Tissues (Biology), Body fluids, Cells (Biology), Scintillation counters, Laboratory equipment, Calcium compounds, Carbonates, Conditioned reflex, Emotions.

Reports on the following topics are summarized: neurobiology, cell ultrastructure, nerve regeneration, and conditioned reflexes.

AD-604 472 Div. 16
OTS Prices: HC $1.00/MF $0.50

University Coll., London (England).
FINAL REPORT. [ON THE MEMORY SYSTEM OF OCTOPUS].
Rept. for Jun 63-64.
1964, 12p
Grant AF EOAR63 2
AFOSR 64 1442

Unclassified report

Descriptors: (*Memory, Cephalopoda), (*Cephalopoda, Memory), (*Nervous system, Cephalopoda), Aquatic animals, Sensory perception, Stimulation, Vision, Reflexes, Learning, Behavior, Brain, Digestive system, Poisoning, Electron microscopy, Cells (Biology), Taste, Nerve fibers, Appetite, Pain.

Work done on the memory system of the octopus is reported. Aspects considered include: (1) analysis of the functions of the pairs of centres concerned with the signals of results; (2) effects of hunger and taste of food; (3) comparison of effects of removing vertical and median superior frontal lobes; (4) electron-microscopy of the lobes; (5) connections with the tactile memory system; (6) the mechanism of poisoning, eating and digestion; (7) effects of large amounts of food on behavior; (8) conduction velocities of nerve fibers of different diameters; (9) effect of lesions in the dorsal basal lobe; (10) function of the peduncle lobe; (11) delayed responses and short term memory; and (12) comparison with other animals.

AD-604 477 Div. 16, 28
OTS Prices: HC $1.00/MF $0.50

Chile Univ., Santiago.
ROLE OF THE CEREBRAL CORTEX IN CLASSICAL AND INSTRUMENTAL CONDITIONED REFLEXES.
Final technical rept. for 1 May 63- 30 Apr 64,
by S. Middleton. Aug 64, 6p
Grant AF AFOSR318 63
AFOSR 64 1441

Unclassified report

Descriptors: (*Cerebral cortex, Conditioned reflex), (*Conditioned reflex, Cerebral cortex), Motor reactions, Central nervous system, Heart, Behavior, Learning, Stimulation, Performance tests, Laboratory animals, Brain, Electroencephalography, Thalamus, Thresholds (Physiology), Fear, Psychophysiology, Reports.

Summaries of psychophysiological reports are presented concerning the role of the cerebral cortex in conditioned reflexes.

AD-604 478 Div. 16
OTS Prices: HC $3.00/MF $0.75

Cincinnati Univ., Ohio. Coll. of Medicine.
METABOLIC CHANGES IN HUMANS FOLLOWING TOTAL BODY IRRADIATION.
Rept. for 1 Nov 61-30 Apr 63,
by Eugene L. Saenger. 30 Apr 63, 65p
Contract DA49 146XZ029
DASA 1422

Unclassified report

Descriptors: (*Whole body irradiation, Metabolism), (*Partial body irradiation, Metabolism), (*Military medicine, Whole body irradiation), Diagnosis, Therapy, Medical examination, Radiation effects, Dosage, Pathology, Dosimeters, Radioactive isotopes, Tolerances (Physiology), Radiation sickness, Hematology, Gamma rays.

The work and interpretation are presented of studies carried out on 19 patients given whole body irradiation. These studies are designed to obtain new information about the metabolic effects of total body and partial body irradiation so as to obtain a better understanding of these acute and subacute effects in human beings. This information is necessary to provide knowledge of combat effectiveness of troops and to develop additional methods of diagnosis, prognosis, prophylaxis and treatment of these injuries.

A STUDY OF FUNDAMENTAL FACTORS PERTINENT TO MICROBIOLOGICAL WASTE CONVERSION IN CONTROL OF ISOLATED ENVIRONMENTS.
Technical rept. no. 1,
by C. G. Golueke, W. J. Oswald, and H. K. Gee.
31 Mar 64, 94p SERL-64-5
Contract AF19 628 2462, Proj. 6694, Task 669404
AFCRL 64 341

Unclassified report

Descriptors: (*Algae, Photosensitivity (Biological)), (*Space biology, Algae), (*Biological products, Algae), Growth, Culture media, Chlorophylls, Photosynthesis, Microorganisms, Space environmental conditions, Light, Degradation, Illumination, Weightlessness, Models (Simulations), Equations, Electrodialysis.

The report is concerned with the determination of an optimum light arrangement for promoting algae growth, the design and construction of a unit incorporating these findings, the design and operation of specialized units to obtain effective waste treatment, and the development of an advanced model of the microterella. The experiments concerned with the geometry of the light source were done with the use of shallow (1 cm with respect to light source) cultures. Highest daily yields were obtained with a bilateral-alternate arrangement of light source, despite the fact that some inhibition may have been caused by an excessively high light intensity, as was evidenced by the relatively low chlorophyl content (0.87 per cent) of the algae cells. A novel lightweight system, the algatron, was developed in which photosynthetic and nonphotosynthetic microorganisms could be cultured at a controlled depth either in a weightless state or in a gravitational field and with an extremely efficient utilization of electrical and either solar or artificial light energy. The principles involved and the results of experiments with a preliminary model are presented in detail.

AD-604 883 Div. 16
OTS Prices: HC $2.00/MF $0.50

Electronics Research Lab., Montana State Coll., Bozeman.
TOWARDS A THEORY OF THE RETICULAR FORMATION.
Scientific rept. no. 1,
by W. L. Kilmer and W. S. McCulloch.
Apr 64, 46p ERL-8-0009-622
Contracts AF19 628 3807, DA36 039AMC03200E, Proj. 5632, Task 563202
AFCRL 64 463

Unclassified report

Descriptors: (*Central nervous system, Mathematical models), (*Neuromuscular transmission, Theorems), Nerve cells, Nerve fibers, Nerve impulses, Circuits, Physiology, Vertebrates, Sensory perception, Matrix algebra, Probability.

Throughout the life of the vertebrates, the core of the central nervous system, sometimes called the reticular formation, has retained the power to commit the whole animal to one mode of behavior rather than another. Its anatomy, or wiring diagram, is fairly well known, but to date no theory of its circuit action has been proposed that could possibly account for its known performance. Its basic structure is that of a string of similar modules, wide but shallow in computation everywhere, and connected not merely from module to adjacent module, but by long jumpers between distant modules. Analysis of its circuit actions heretofore proposed in terms of finite automata or coupled nonlinear oscillators has failed. Probabilistic automata which handle regular events as proper modules are proposed and some novel stability theorems are given regarding them. The behavior of a connected chain of such modules is still under investigation. (Author)

AD-604 982 Div. 16
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A SIMPLE MODEL FOR THE PRODUCTION OF THE NORMAL ELECTROENCEPHALOGRAM,
by John L. Kennedy and William H. Emmons.
25 Jan 56, 18p P-795

Unclassified report

Descriptors: (*Electroencephalography, Anatomical models), (*Brain, Anatomical models), Nervous system, Physiology, Cerebral cortex, Oscillation, Gels, Voltage, Cardiovascular system, Cerebrospinal fluid, Pulse rate.

A simple electromechanical theory for the production of the normal electroencephalogram is outlined. The theory requires three sets of conditions in the brain: (1) an electrically-charged state, presumed to arise through chemical oxidation-reduction reactions, (2) a gel mass, with a coefficient of elasticity approximated by commercial gelatin, and (3) a periodic mechanical pulse, to set the gel into oscillation at its resonant frequency. It is proposed that the interaction of these conditions in the skull produces the oscillating potentials recorded from normal human subjects by standard electroencephalographic equipment. It is further proposed that blocking of the alpha rhythm may be produced by de-tuning the lobes of the brain through changes in blood supply via cortical vasoconstriction and dilation. Some suggestions are made concerning likely sources of mechanical activity which might produce abnormal EEG patterns.

occurred as indicators of stress. In similar experiments when Coriolis acceleration was additionally imposed during zero gravity, much greater stress was indicated by the same measurements. Subjects with meningitis-derived labyrinthine defects did not respond in a similar manner. It is concluded that functionally intact vestibular organs must be present to activate the hypothalmic-pituitary-adrenal axis in abnormal G environment. (Author)

AD-604 658 Div. 16
OTS Prices: HC $1.00/MF $0.50

Geoscience, Ltd., La Jolla, Calif.
THERMAL AND ELECTRICAL CONDUCTIVITIES OF BIOLOGICAL FLUIDS AND TISSUES.
Quarterly rept. for 1 Apr-30 Jun 64,
by H. F. Poppendiek, N. D. Greene, P. M. Morehouse, R. Randall, and J. R. Murphy. 30 Jun 64, 25p GLR-28
Contract Nonr4095 00

Unclassified report

See also AD-438 144.

Descriptors: (*Body fluids, Conductivity), (*Tissues (Biology), Conductivity), Thermal conductivity, Electrical conductance, Blood, Urine, Stomach, Secretion, Enzymes, Eye, Electrolytes (Physiology), Skin, Lungs, Liver, Kidneys, Brain, Biophysics, Medical equipment, Cryogenics.

The report describes research on thermal and electrical conductivities of biological fluids and tissues. Experimental electrical conductivities of human gastric juices, urine and bovine aqueous and vitrious humours were determined. A special cell for the determination of electrical conductivities for tissues was designed, constructed, and tested. Experimental measurements of the electrical conductivity of cow blood was determined as a function of hemolysis. A modified thermal conductivity apparatus was used to measure the conductivities of beef lung, liver, kidney, brain and chicken skin. Thermal conductivity correlation expressions for biological fluids and tissues are evaluated. (Author)

AD-604 802 Div. 16, 28
OTS Prices: HC $3.00/MF $0.75

RAND Corp., Santa Monica, Calif.
LONG-LASTING EFFECTS OF LSD ON CERTAIN ATTITUDES IN NORMALS: AN EXPERIMENTAL PROPOSAL,
by William H. McGlothlin. May 62, 66p P-2575

Unclassified report

Descriptors: (*Lysergic acids, Reaction (Psychology)), (*Reaction (Psychology), Lysergic acids), Drugs, Dosage, Chemotherapy, Psychometrics, Personality, Emotions, Attitudes, Behavior, Memory, Social communication, Psychophysiology, Psychiatry, Abnormal psychology, Psychoses, Neuroses, Adjustment (Psychology), Perception (Psychology), Tolerances (Physiology), Central nervous system.

Research into the long-lasting effects of administering d-lysergic acid diethylamide (LSD) to normals is discussed. In addition to its use in psychotherapy, there were some reports of experimental subjects who claim lasting beneficial effects attributable to the LSD experience. In particular, two follow-up questionnaire studies indicated that normal subjects frequently claim changes in personality resulting from only one or two administrations of LSD, and these claims were maintained after periods of a year or more. These results are subject to the weaknesses of the questionnaire method; but, when considered along with some of the literature on the use of LSD in psychotherapy, they appear to be sufficiently suggestive to warrant more controlled experiments in this area. An experiment is suggested which would attempt to measure any long-lasting changes in attitudes, values, and communicative ability resulting from the administration of LSD. In particular, the measures would concentrate on changes in closed-mindness as reflected by scales of dogmatism, opinionation, and ethnocentricity.

AD-604 807 Div. 16, 12
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
EXPERIMENTS IN INTERPLANETARY BIOMIGRATION AND SPACE CONTAMINATION,
by I. Cooper and A. G. Wilson. 16 Jun 58, 14p P-1406

Unclassified report

Condensed version read at the Symposium on Possible Uses of Earth Satellites for Life Sciences Experiments, Washington, D. C., 14-17 May 58.

Descriptors: (*Space environmental conditions, Biological contamination), (*Biological contamination, Space flight), (*Space biology, Biological contamination), Ecology, Space probes, Reentry vehicles, Purification, Satellites (Artificial), Microogranisms, Planets, Viability, Bacteria, Viruses, Spores, Seeds, Environmental tests.

The likelihood of auto-and-ancillary migration of viable micro-organisms is discussed. Experiments are suggested to determine the survival potentials of micro-organisms under various space conditions, to establish the extent to which space sterilization of interplanetary instrument probes and other space vehicles may be relied upon to prevent the infecting of other celestial bodies, (or the infecting of the earth with alien life by returning probes), and to determine whether further sterilization procedures would be required.

AD-604 820 Div. 16, 12
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
OBJECTIVES OF USE OF INDIGENOUS RESOURCES FOR MANNED EXTRATERRESTRIAL BASES,
by E. A. Steinhoff. Jun 62, 8p P-2604

Unclassified report

Presented before the Working Group on 'Use of Indigenous Resources for Manned Extraterrestrial Bases,' held at The RAND Corp., 22 Jun 62.

Descriptors: (*Mars, Extraterrestrial bases), (*Extraterrestrial bases, Logistics), (*Closed ecological systems, Extraterrestrial bases), Costs, Life support, Water, Food, Oxygen, Hydrogen, Fuels, Nutrition, Manned, Transportation, Storage.

An analysis of the support requirements for manned Mars missions is presented. Considered in the discussion are the costs and problems of life support which would be involved in the establishment of extraterrestrial bases.

AD-604 882 Div. 16
OTS Prices: HC $3.00/MF $0.75

Sanitary Engineering Research Lab., Univ. of California, Berkeley.

BERYLLIUM RESEARCH AND DEVELOPMENT IN THE AREA OF COMPOSITE MATERIALS.
Quarterly progress rept. no. 1, 1 Jul-30 58,
by J. Greenspan and A. R. Kaufmann. 1 Dec 58, 33p
NMI 9402
Contract AF33 616 5912

Unclassified report

Descriptors: (*Beryllium, Composite materials), (*Composite materials, Beryllium), Mechanical properties, Deformation, Ductility, Laminates, Aluminum, Cladding, Stainless steel, Brazing, Coatings, Aluminum alloys, Silicon alloys.

The effect of sample width on bend ductility is given for one type of grain-oriented beryllium, for which tensile properties are known. Bend ductility dropped off sharply as relatively narrow widths of the order of 1/4 - 3/8 inch were exceeded. Composites consisting of alternate strips of beryllium and aluminum in single layer were formed by aluminum-silicon brazing. An effort was made to determine the dependence of bend ductility, around a 0.200-inch radius, on width of aluminum filler strip. Bend ductility was compared to (1) that of the individual beryllium strip, and (2) that of a beryllium sheet having width equivalent to the sum of beryllium strip widths in the composite. The magnitude of bend ductility in the composite was found to be intermediate between (1) and (2) above. Several Samples braze clad with 316 stainless steel were subjected to bend tests, as were several strip samples of various widths which were coated with Al-Si braze metal.

AD-604 599 Div. 17
OTS Prices: HC $4.00/MF $0.75

Lockheed Missiles and Space Co., Palo Alto, Calif.
BERYLLIUM RESEARCH AND DEVELOPMENT PROGRAM. METALLURGICAL FACTORS AFFECTING THE DUCTILE-BRITTLE TRANSITION IN BERYLLIUM.
Rept. for 1 Oct 61-31 Mar 63,
by M. I. Jacobson. Jul 64, 107p
Contract AF33 616 7065, Proj. 7351, Task 735104
ASD TDR62 509 V5

Unclassified report

Descriptors: (*Beryllium, Powder metallurgy), (*Powder metallurgy, Beryllium), (*Transition temperature, Beryllium), Ductility, Brittleness, Material forming, Powder metals, Heat treatment, Extrusion, Aging (Materials), Temperature, Particle size, Grain structures (Metallurgy), Microstructure, Photomicrography, Tensile properties, Strain (Mechanics), Extrusion, Stresses, Tests, Theory, Impurities, Experimental data, Mechanical properties.

An investigation was made of the factors controlling the ductile-brittle behavior of two grades of commercial purity beryllium, Brush QMV and Pechiney CR. Tensile tests were made on randomly oriented samples at temperatures from 23C to 500C. Extrusions were tested in the longitudinal and transverse directions in the range -195C to 200C. Three grain sizes of each material were investigated, and comparisons made between specimens tested in the aged and unaged condition. The aging treatment was 900C for 6 hours followed by 48 hours at 700C. Mechanical properties of both materials were very similar after this heat treatment and no advantage could be claimed for the higher purity Pechiney beryllium. Aging reduced the amount of impurities in solid solution and contributed to improved ductility in certain temperature ranges. The ductile-brittle transition could not be described in terms of the dislocation pileup theories for body-centered-cubic metals. A theory of the ductile-brittle transition based on the thermally activated cross slip of screw dislocations from the basal plane into pyramidal or prismatic planes was proposed. The data could be described reasonably well in terms of this theory.

AD-604 738 Div. 17
OTS Prices: HC $6.00/MF $1.50

General Electric Co., Cincinnati, Ohio.
PROCEDURE FOR EVALUATION OF COATED REFRACTORY ALLOYS.
Rept. for Apr 61-30 May 62,
by M. A. Levinstein and J. D. Marble. Jun 64, 287p
Contract AF33 616 8154, Projs. 7381, 7312, Task 738102
ML TDR64 70

Unclassified report

Formerly pub. as ASD-TDR-62-783, PB-163 806.

Descriptors: (*Refractory metal alloys, Test methods), (*Molybdenum alloys, Test methods), (*Niobium alloys, Test methods), (*Refractory coatings, Effectiveness), Oxidation, Inhibition, Metallography, Hardness, Mechanical properties, Stresses, Fatigue (Mechanics), Tensile properties, Standards.

Procedures for the evaluation of coated molybdenum and columbium alloys were investigated. A simple corrugated specimen was designed to determine the applicability of current coatings to a fabricated structure. Coated specimens were oxidation tested at 2500F up to 10 hours, and sectioned for metallographic examination and hardness determination. Dynamic oxidation tests were conducted using a gas-fired flame tunnel and a plasma test stand. Effects of the coatings and elevated temperature exposure on basis metal properties were established by combined stress, fatigue, and tensile tests. Coatings from six sources were investigated on the program. Based on the results obtained recommendations are made for the standardization of the applicability specimen and combined stress testing along with other mechanical tests for the evaluation of coated refractory metals. (Author)

AD-604 750 Div. 17, 14, 27.
OTS Prices: HC $3.00/MF $0.75

Aerojet-General Corp., Azusa, Calif.
STRESS-CORROSION CRACKING OF HIGH-STRENGTH ALLOYS.
Final rept. for 1 Jul 63-1 Jul 64,
by A. Rubin. Aug 64, 80p AGC-2914
Contract DA04 495ORD3069

Unclassified report

Descriptors: (*Maraging steels, Corrosion), (*Corrosion, Maraging steels), (*Coatings, Maraging steels), Stresses, Environmental tests, Corrosion inhibition, Plastic coatings, Aging (Materials), Steel, Heat treatment, Rocket cases, Cobalt alloys, Molybdenum alloys, Ductility, Electron microscopy, Failure (Mechanics), Fracture (Mechanics), Electrochemistry, Isocyanate plastics, Epoxy plastics, Titanium alloys, Tool steel, Cold working, Zinc coatings, Sodium compounds, Chlorides, Protective treatments.

Susceptibility to stress-corrosion failure was found in all 18%-nickel alloy heats having yield strengths from 181.5 to 232.2 ksi. Susceptibility became greater with increasing titanium content and yield strength. At a given strength level, 18%-nickel maraging steel was less susceptible to failure than was H-11 steel or a hot-worked die steel. Cold working of 18%-nickel maraging steel before aging further reduced its susceptibility to stress-corrosion failure. Distilled water was a more severe exposure medium than 3%-salt water in causing

17. Metallurgy

AD-604 337 Div. 17
OTS Prices: HC $1.00/MF $0.50

Naval Research Lab., Washington, D. C.
EFFECT OF OXYGEN ON CREEP-RUPTURE OF NIOBIUM.
Interim rept.,
by J. Stoop and P. Shahinian. 10 Jul 64, 21p
Contract AT49 5 1907, Proj. RR007 01 46 5407
NRL 6095

Unclassified report

Descriptors: (*Niobium, Creep), (*Creep, Niobium), Oxygen, Creep, Rupture, Ductility, Hardness, Cold working, Heat of activation, High-temperature research, Contamination, Solid solutions, Microstructure, Impurities, Gases.

The creep-rupture properties of electron-beam-melted niobium with additions of oxygen up to 0.35 weight-percent were determined at 1900F (1038C), 2300F (1260C), and 2600F (1427C) at vacuums of 1 x .00001 torr or better. Rupture life generally increased and minimum creep rate decreased as the level of oxygen was raised. There was no deleterious effect on ductility even with the high oxygen additions. Increases in hardness as a function of cold work and oxygen content were obtained. Activation energies for high-temperature creep were determined which showed good agreement with the reported experimental activation energies for self-diffusion. At 1900F, but not at 2300 and 2600F, an anomalous behavior occurred which was manifested by a rapid acceleration followed by a deceleration in the flow process. The irregularity, which is represented as a step in the creep curve, occurs only under certain combinations of temperature, stress, and oxygen content. It appears to be related to substructure formation, and not to recrystallization or grain growth. (Author)

AD-604 343 Div. 17, 25
OTS Prices: HC $6.00/MF $1.25

Foreign Tech. Div., Air Force Systems Command, Wright-Patterson AFB, Ohio.
NONFERROUS METALLURGY, 1963 VOL. 6, NO. 4,
29 Jun 64, 221p
FTD MT64 15; TT 64 71238

Unclassified report

Edited machine trans. of Izvestiya Vysshikh Uchebnykh Zavedenii. Tsvetnaya Metallurgiya (USSR) 1963, v. 6, no. 4, p. 1-151.

Descriptors: (*Metallurgy, Scientific research), (*Reports, Metallurgy), Drills, Mining engineering, Cooling, Graphics, Floatation (Separation), Ores (Metal sources), Chemical engineering, Surface properties, Dynamics, Copper, Nickel, Iron, Metals, Slags, Zinc, Silver, Analysis, Magnesium, Vanadium, Bismuth, Uranium, Oxides, Physical properties, Crystal structure, Titanium, Plating, Corrosion, USSR, Periodicals, Reviews.

AD-604 440 Div. 17
OTS Prices: HC $3.00/MF $0.75

Thompson Ramo Wooldridge Inc., Cleveland, Ohio.
FRACTURE CHARACTERISTICS OF STRUCTURAL METALS.
Quarterly progress rept. no. 1, 22 Jan-22 Apr 64,
by M. F. Amateau, G. L. Hanna, and E. A. Steigerwald.
30 Apr 64, 93p TRW-ER-5937
Contract NOw64 0186C

Unclassified report

Descriptors: (*Steel, Fracture (Mechanics)), (*Titanium alloys, Fracture (Mechanics)), (*Fracture (Mechanics), Structural parts), Tool steel, Stainless steel, Alloys, Metals, Chrominum alloys, Nickel alloys, Aluminum alloys, Vanadium alloys, Cobalt alloys, Sheets, Toughness, Mathematical analysis, Stresses, Structures, Transition temperature, Tensile properties, Heat treatment, Mechanical properties.

This report was divided into two parts. The first consists of the results of a literature survey being conducted to assemble K sub IC data for possible use in handbook form. In addition, selected tests have been initiated to determine the influence of specimen geometry and processing conditions on the toughness parameter. The second section summarizes results obtained from a study to determine the effect of test conditions on the measurement of accurate K sub IC values from sheet specimens. The data presented in this section indicate that the initiation of slow crack growth can be categorized into three distinct types which correlate with the macroscopic fracture mode of the specimens. In the temperature region where no shear failure occurred, the initiation of slow crack growth was coincident with complete specimen failure. In the transition region, where the fracture mode contained both flat and shear areas, the onset of slow cracking was characterized by a discontinuity in the measurement of crack propagation (pop in), while at temperatures where the fracture mode was completely shear, the initiation of slow crack propagation occurred with no obvious discontinuity.

AD-604 570 Div. 17
OTS Prices: HC $3.00/MF $0.75

Thompson Ramo Wooldridge, Inc., Cleveland, Ohio.
FRACTURE CHARACTERISTICS OF STRUCTURAL METALS.
Quarterly progress rept. no. 2, 22 Apr-22 Jul 64,
by M. F. Amateau and E. A. Steigerwald. 15 Aug 64,
86p TRW-ER-5937-1
Contract NOw64 0186C

Unclassified report

Descriptors: (*Titanium alloys, Toughness), (*Fracture (Mechanics), Metals), (*Steel, Toughness), (*Aluminum alloys, Toughness), Tool steel, Temperature, Nickel alloys, Chromium alloys, Molybdenum alloys, Iron alloys, Aging (Materials), Heat treatment, Metallography, Cobalt alloys, Experimental data, Vanadium alloys, Maraging steels, Tests, Tensile properties, Zinc alloys, Magnesium alloys.

The purpose of this program is to evaluate the use of plane strain fracture toughness (K sub IC) as a possible parameter for handbook application. During this report period, a literature survey dealing with the assembly of pertinent K sub IC data has been continued. The experimental effort has involved the determination of plane strain fracture toughness in specimens taken from 8-inch square forged billets of H-11 and 4340 steels. The results indicate that K sub IC did not vary significantly as a function of specimen position within the billet. The room temperature K sub IC parameter for AM 355 steel at aging temperatures between 850F and 1025F was also evaluated. (Author)

AD-604 584 Div. 17
OTS Prices: HC $2.00/MF $0.50

Nuclear Metals, Inc., Concord, Mass.

Quarterly progress rept. no. 4, 1 Apr-30 Jun 64,
by L. F. Porter, A. M. Rathbone, S. T. Rolfe, and K. E. Dorschu. 1 Jul 64, 82p
Contract NObs88540, Projs. SR007 01 01, 40 018 001 31, Task 853

Unclassified report

Descriptors: (*Welding, Steel), (*Maraging steels, Welding), (*Submarine hulls, Welding), Thermal joining, Welds, Nickel alloys, Chromium alloys, Molybdenum alloys, Vanadium alloys, Manganese alloys, Stresses, Melting, Forging, Casting, Chemical analysis, Fracture (Mechanics), Tensile properties, Loading (Mechanics), Structural properties, Electrodes, Fatigue (Mechanics), Corrosion, Toughness, Stresses, Material forming.

Laboratory development studies on the base metal were completed, and the results indicate that the 5Ni-Cr-Mo-V steel appears to be the optimum composition for an HY-130/150 steel. A second 80-ton electric-furnace heat, a 40-ton basic-oxygen-steelmaking (OSM) heat, and a 40-ton OSM vacuum-carbon-deoxidized heat of the 5Ni-Cr-Mo-V steel have been melted and are being evaluated. Ingots have also been cast from an OSM heat of the 5Ni-Cr-Mo-V steel for consumable-electrode remelting and for processing to a ring forging, and plans for producing castings and structural shapes have been formulated. The studies should indicate the suitability of the 5Ni-Cr-Mo-V steel for the various types of products required for submarine-hull construction, and should establish the composition ranges for the various 5Ni-Cr-Mo-V steel products. Laboratory base-metal weldability studies, which defined composition limits for the 5Ni-Cr-Mo-V steel, have been completed. As anticipated, the heat-affected-zone crack susceptibility of the first production heat of the 5Ni-Cr-Mo-V was low, and its heat-affected-zone toughness was high. Covered-electrode and MIG weld metals of improved strength and toughness have been developed, and work to develop an all-position technique for depositing MIG filler metals is progressing on schedule. (Author)

AD-604 871 Div. 17, 26, 30,
OTS Prices: HC $1.00/MF $0.50

United States Steel Corp., Monroeville, Pa.
DEVELOPMENT OF A DROP-WEIGHT-BULGE TEST, I
Technical rept.,
by S. T. Rolfe and L. P. Connor. 1 Jul 64, 20p
Contract NObs88540, Projs. SR007 01 01, 40.018 001 26, Task 853

Unclassified report

Descriptors: (*Drop testing, Metal plates), (*Steel, Drop testing), (*Welds, Drop testing), Test equipment, Nickel alloys, Chromium alloys, Molybdenum alloys, Vanadium alloys, Submarine hulls, Strain (Mechanics) Loading (Mechanics), Deformation, Test methods.

A laboratory test is described in which plate specimens could be 1:1 biaxially strained at relatively high loading rates to produce deformations similar to those observed in the explosion-bulge test plates. Results of extensive experimentation indicate that the deformation distribution observed in explosion-bulge test plates can be simulated in a 1/2-inch-thick plate if a 14-inch-square test specimen is placed on top of a 9-inch-inside-diameter anvil and impacted by a 5-1/2-inch-diameter hemispherical striker. The striker transmits an energy of 20,000 ft-lb to the plate through aluminum pads that distribute the strain throughout the plate bulge. Examination of drop-weight-bulge specimens of a 1/2-inch-thick, 150 ksi yield-strength 5Ni-Cr-Mo-V steel showed that the strain field was uniform throughout a 2-inch-diameter polar region. The surface strain in this region was 0.2 inches/inch and the thickness reduction was 30 percent. Thus, the drop-weight-bulge test appears suitable for evaluating the capacity of plates and weldments to deform under high strain 1:1 biaxial loading.

AD-604 872 Div. 17
OTS Prices: HC $2.00/MF $0.50

United States Steel Corp., Monroeville, Pa.
EFFECT OF CARBON ON THE HARDENABILITY AND MECHANICAL PROPERTIES OF 5Ni-Cr-Mo-V STEEL.
Technical rept.,
by S. J. Manganello and L. F. Porter. 1 Jul 64, 50p
Contract NObs88540, Projs. SR007 01 01, 40.018 001 25, Task 853

Unclassified report

Descriptors: (*Steel, Mechanical properties), (*Refining (Metallurgy), Steel), Carbon alloys, Nickel alloys, Chromium alloys, Molybdenum alloys, Vanadium alloys, Chemical analysis, Tensile properties, Hardness, Toughness, Metal plates, Welding, Heat treatment, Metal plates.

Seven Laboratory 5Ni-Cr-Mo-V steels containing 0.05 to 0.27 percent carbon were evaluated to establish the carbon-ordering range for the 5Ni-Cr-Mo-V steel as an HY-130/150 steel and to determine the potential of the 5Ni-Cr-Mo-V steel as an HY-180/210 steel. The results showed that an average yield strength of about 140 ksi should be obtained in 1/2-inch-thick water-quenched production plates at a carbon content of about 0.045 percent, but that a minimum carbon content of about 0.085 percent should be specified to obtain similar properties at the midthickness of 4-inch-thick water-quenched plates. Therefore, an ordering range of 0.08 to 0.13 percent carbon is recommended for the 5Ni-Cr-Mo-V steel to insure the desired strength, toughness, and weldability for an HY-130/150 steel. In the tempering range 900 to 1200 F, none of the steels investigated exhibited a yield strength of 180 ksi. The high-carbon steels from the present study and other experimental steels are being evaluated at lower tempering temperatures to determine their potential as HY-180/210 steels.

AD-604 873 Div. 17, 26, 31
OTS Prices: HC $3.00/MF $0.75

United States Steel Corp., Monroeville, Pa.
FORMABILITY OF EXPERIMENTAL HY-130/150 STEELS.
Technical rept.,
by S. T. Rolfe. 1 Jul 64, 86p
Contract NObs88540, Projs. SR007 01 01, 40.018 001 27, Task 853

Unclassified report

Descriptors: (*Steel, Mechanical properties), (*Submarine hulls, Steel), (*Test methods, Steel), Nickel alloys, Chromium alloys, Molybdenum alloys, Vanadium alloys, Carbon alloys, Metal plates, Tensile properties, Deformation, Stresses, Strain (Mechanics), Fracture (Mechanics), Material forming, Tests, Ductility.

Laboratory studies were initiated on steels having yield strengths of 92 to 169 ksi to establish correlations between bend-test results and tension-test results. The results of plane-strain bend tests on 1/4- and 3/8-inch-thick specimens showed that bend angle depends on the test setup and thus is not a broad indicator of formability. However, onset of surface cracking was found to depend on the true surface strain of the bend specimen regardless of the test setup. Thus true surface strain, which can be conveniently determined from the specimen curvature (ratio of specimen thickness, h sub o, to outside bend radius, r sub o) appears to be the best indicator of formability in the bend test. The results of tension tests indicated that specimen curvature in the bend test correlated satisfactorily with reduction of area in the tension test. Thus, formability by plane-strain bending can be predicted from simple uniaxial tension tests. On the basis of a minimum reduction of area of 60 percent for the experimental HY-130/150 steels, minimum inside bend

corrosion cracking, and the U-bend test was more severe than the bent-beam test - at least with regard to 18%-nickel maraging steel. The 18%-nickel maraging steel showed a marked increase in susceptibility to stress-corrosion cracking with an increase in environmental temperature. An inhibited epoxy coating designated as 454-1-1 was very effective in greatly delaying stress-corrosion cracking both of maraging steels and of H-11 steel. An inorganic zinc coating designed to impart cathodic protection was found to be ineffective. An electrochemical mechanism for failure of maraging steel in 3%-NaCl solution was demonstrated by the preventing of stress-corrosion failure upon application of cathodic current.

AD-604 867 Div. 17
OTS Prices: HC $2.00/MF $0.50

United States Steel Corp., Monroeville, Pa.
EFFECTS OF COMPOSITION VARIATIONS ON THE PROPERTIES OF 5Ni-Cr-Mo-V STEEL.
Technical rept.,
by S. J. Manganello and L. F. Porter. 1 Jul 64, 46p
Contract NObs88540, Projs. SR007 01 01, 40 081 001 30, Task 853

Unclassified report

Descriptors: (*Steel, Mechanical properties), (*Refining (Metallurgy), Steel), Nickel alloys, Chromium alloys, Molybdenum alloys, Vanadium alloys, Chemical analysis, Tensile properties, Toughness, Melting, Rolling (Metallurgy), Heat treatment, Hardness, Microstructure, Metal plates, Carbon alloys, Vacuum.

Four composition modifications of a 0.10 percent carbon 5Ni-Cr-Mo-V steel and three modifications of a 0.15 percent carbon 5Ni-Cr-Mo-V steel were investigated. Among the 0.10 percent carbon steels, the standard 5Ni-Cr-Mo-V steel and a 0.9 Mn, 0.04 Si modification exhibited the best combination of yield strength (140 to 150 ksi) and notch toughness (80 to 120 ft-lb at 0 F). Severe embrittlement occurred when the chromium content was increased to 1.25 percent and a general loss in toughness resulted when aluminum was eliminated. Increasing the carbon content of the 5Ni-Cr-Mo-V steel from 0.10 percent to 0.15 percent increased the yield strength (after appropriate tempering) from the 130/150 ksi range to the 150/165 ksi range, but decreased the notch toughness at 0 F to the 50 to 90 ft-lb range. At the higher carbon content, the notch toughness was somewhat improved when the manganese and silicon contents were reduced. The results indicate that the standard 0.10 percent carbon 5Ni-Cr-Mo-V steel has the best composition for a steel capable of developing a yield strength of 140 to 150 ksi and exceptional notch toughness. A 0.15 percent carbon 5Ni-Cr-Mo-V steel also exhibits good notch toughness at yield strengths of 150 to 165 ksi. (Author)

AD-604 868 Div. 17
OTS Prices: HC $3.00/MF $0.50

United States Steel Corp., Monroeville, Pa.
A METALLOGRAPHIC INVESTIGATION OF THE FACTORS AFFECTING THE NOTCH TOUGHNESS OF MARAGING STEELS.
Technical rept.,
by A. J. Birkle, D. S. Dabkowski, J. P. Paulina, and L. F. Porter. 1 Jul 64, 58p
Contract NObs88540, Projs. SS050 000, 40 018 002 19, Task 1567

Unclassified report

Descriptors: (*Maraging steels, Toughness), (*Metallography, Maraging steels), Fractography, X-ray diffraction analysis, Electron diffraction analysis, Microscopy, Mechanical properties, Microstructure, Gram structures (Metallurgy), Fracture (Mechanics), Impurities, Zirconium compounds, Nitrides, Titanium compounds, Carbides, Sulfides, Aluminum compounds.

This report describes the results of an investigation of nine maraging steels with widely varying notch toughness (25 to 70 ft-lb Charpy V-notch energy at 190 ksi yield strength). Extraction fractography was used in conjunction with such techniques as light microscopy, thin-film electron microscopy, microprobe analysis, and electron- and X-ray-diffraction analysis to identify the causes for the difference in toughness among the nine steels. The results of the investigation indicate that by examining extraction fractographs with metallographic, X-ray- and electron-diffraction, and microprobe techniques it is possible to isolate the major factors responsible for low notch toughness in maraging steels. Thin-film transmission-electron microscopy and analysis of insoluble residue, while generally substantiating the results obtained by analysis of the fractographs, are less definite and therefore less useful than the fractographic studies.

AD-604 869 Div. 17, 26, 31
OTS Prices: HC $2.00/MF $0.50

United States Steel Corp., Monroeville, Pa.
FEASIBILITY OF DEVELOPING AN HY-180/210 WELDMENT.
Quarterly progress rept. no. 4, 1 Apr-30 Jun 64,
by L. F. Porter, A. M. Rathbone, S. T. Rolfe, and K. E. Dorschu. 1 Jul 64, 50p
Contract NObs88540, Projs. SS050 000, 40 018 002 22, Task 1567

Unclassified report

Descriptors: (*Welding, Steel), (*Maraging steels, Welding), (*Submarine hulls, Welding), Nickel alloys, Chromium alloys, Molybdenum alloys, Vanadium alloys, Cobalt alloys, Metal plates, Heat treatment, Tensile properties, Toughness, Melting, Electrodes, Thermal joining, Forging, Mechanical working, Structural properties, Welds, Fracture (Mechanics), Fatigue (Mechanics), Feasibility studies.

Through the development of improved processing practices on small ingots, the notch toughness of air-melted 12Ni-5Cr-3Mo maraging steel appears to be equivalent to that of vacuum-consumable-electrode remelted 12Ni-5Cr-3Mo steel. Thus, light-gage plates of the 12Ni-5Cr-3Mo steel should now meet the desired minimum strength-toughness objective (50 ft-lb at 180 ksi). However, the notch toughness of the 12Ni-5Cr-3Mo steel in plates over 2 inches thick is presently in the range to 40 ft-lb. Therefore, improvements in the chemical composition and melting practice of the 12Ni-5Cr-3Mo steel are being investigated. In addition, the potential of carbon-martensitic age-hardened steels, conventional quenched and tempered steels, and rapidly heat-treated quenched and tempered steel is still being evaluated. The crack susceptibility and toughness of the heat-affected zones of the various experimental HY-180/210 steels are being evaluated concurrently with the development of the base metals. Modest improvements in the notch toughness of the 12Ni-5Cr-3Mo filler metals have been obtained, but HY-180/210 weld metals having energy absorptions consistently over 30 ft-lb have not as yet been developed. (Author)

AD-604 870 Div. 17, 26, 31
OTS Prices: HC $3.00/MF $0.75

United States Steel Corp., Monroeville, Pa.
DEVELOPMENT OF AN HY-130/150 WELDMENT.

crack susceptibility similar to that of a low-crack-susceptible HY-80 steel. Generally, the results of the present work indicate that the 5Ni-Cr-Mo-V steel has excellent welding characteristics. (Author)

AD-604 879 Div. 17
OTS Prices: HC $2.00/MF $0.50

United States Steel Corp., Monroeville, Pa.
EVALUATION OF MISCELLANEOUS EXPERIMENTAL HY-130/150 STEELS.
Technical rept.,
by D. S. Dabkowski, S. J. Manganello, and L. F. Porter.
1 Jul 64, 30p
Contract NObs88540, Projs. 40 018 001 29, SR007 01 01, Task 853

Unclassified report

Descriptors: (*Steel, Mechanical properties), Manganese alloys, Nickel alloys, Chromium alloys, Molybdenum alloys, Heat treatment, Tensile properties, Toughness, Metal plates, Rolling (Metallurgy), Refining (Metallurgy), Carbon, Sulfur.

The experimental HY-130/150 steels investigated consist of three Mn-Ni-Cr-Mo steels, three 5 1/4- to 7 1/2-percent-nickel steels, four 5Ni-Cr-Mo steels, and two HY-80 steels. The results of the evaluation of the twelve steels indicated that none of the steels was particularly attractive as an HY-130/150 steel and that each steel exhibited one or more shortcomings, such as inadequate hardenability, low strength, poor notch toughness, or lack of sufficient resistance to softening on tempering. However, the studies did show that a reduction in the carbon, manganese, and/or sulfur content significantly improved the notch toughness of the 5Ni-Cr-Mo steels. However, compensating alloy additions must be made to offset the loss in hardenability when carbon and manganese are reduced. (Author)

AD-604 994 Div. 17
OTS Prices: HC $1.00/MF $0.50

Naval Research Lab., Washington, D. C.
EVALUATION OF VACUUM ARC MELTED VASCOJET-1000,
by H. O. Ewing. 10 Jun 60, 6p
Proj. 62R19 05, Task 71402
NRL TM128

Unclassified report

Descriptors: (*Steel, Refining (Metallurgy), Chromium alloys, Molybdenum alloys, Sheets, Refining (Metallurgy), Vacuum, Melting, Toughness, Tensile properties, Fracture (Mechanics), Microstructure.

This cleaner Vascojet-1000 is approximately two to three times tougher than the previous material tested here. The edge notched specimens gave a lower toughness value possibly because they had a sharper initial crack. The high oxygen content of the air melted Vasco X-3 may have been an embrittling agent as the toughness values of the X-3 were low. The microphotographs show typical inclusions present in the two steels.

radii from 0.4 inch for 1/4-inch-thick plate to 7.1 inches for 4-inch-thick plate are predicted. These bend radii indicate that the experimental HY-130/150 steels are capable of meeting the forming requirements for submarine hulls.

AD-604 874 Div. 17, 26
OTS Prices: HC $3.00/MF $0.75

United States Steel Corp., Monroeville, Pa.
THE PRODUCTION AND PROPERTIES OF 180 Ksi MINIMUM-YIELD-STRENGTH MARAGING STEELS.
Technical rept.,
by D. S. Dabkowski, L. F. Porter, and G. E. Loveday.
20 May 64, 94p
Contract NObs88608, Proj. 40 018 007 1
Unclassified report

Descriptors: (*Maraging steels, Mechanical properties), (*Refining (Metallurgy), Maraging steels), (*Metal plates, Maraging steels), Steel, Nickel alloys, Chromium alloys, Molybdenum alloys, Hemispherical shells, Electrodes, Welding, Aging (Materials), Tensile properties, Toughness, Melting, Heat treatment, Grain structures (Metallurgy), Microstructure.

This report describeds the production and properties of hemispheres produced from 5/8-inch-thick plate, of 1/4-, 1/2-, 1-1/4-, 1-1/2-, 1-3/4-, 2-, 3-, and 4-1/2-inch-thick plates, and of 1/16-inch-diameter welding electrodes produced under this contract. Plates for 5/8-inch-thick hemispheres were from a part of an 80-ton electric-furnace heat of 18Ni-8Co-2.6Mo steel. Because plates 1 inch thick and over from this heat did not meet the Charpy impact-test specifications, all plates other than the 5/8-inch-thick plate were produced from 20-ton electric-furnace heats of 12Ni-5Cr-3Mo steel. Welding electrodes of both the 18Ni-8Co-2.6Mo and 12Ni-5Cr-3Mo steel compositions were produced from 300-pound vacuum-induction furnace heats. The results of tension and impact tests showed that all materials met the mechanical-property specifications. In addition, the results of supplementary studies on aging response, stress-strain characteristics in tension and compression, moduli of elasticity, coefficients of thermal expansion, transformation temperatures, and grain size and microstructure of the two steels are reported. (Author)

AD-604 876 Div. 17
OTS Prices: HC $1.00/MF $0.50

United States Steel Corp., Monroeville, Pa.
THE EFFECTS OF LOW-TEMPERATURE TEMPERING ON THE PROPERTIES OF 0.25 PERCENT CARBON Ni-Cr-Mo STEELS.
Technical rept.,
by S. J. Manganello and L. F. Porter. 1 Jul 64, 44p
Contract NObs88540, Projs. 40 018 002 20, SS050 000, Task 1567
Unclassified report

Descriptors: (*Steel, Heat treatment), (*Heat treatment, Steel), Nickel alloys, Chromium alloys, Molybdenum alloys, Carbon alloys, Metal plates, Tensile properties, Toughness, Hardness, Temperature, Microstructure, Vanadium alloys, Niobium alloys.

Five selected steels (3Ni-Cr-Mo-Cb, 3Ni-Cr-Mo, 5Ni-Cr-Mo, and two 5Ni-Cr-Mo-V steels) containing 0.22 to 0.27 percent carbon were evaluated after tempering at appropriate temperatures to determine their suitability as HY-180/210 steels. The results indicated generally that the five steels had adequate hardenability for 4-inch-thick plates and that yield strengths of about 185 ksi were attained at a carbon content of 0.25 percent carbon when the steels were tempered at temperatures in the range 400 to 1000 F. In addition, none of the steels was significantly embrittled by tempering. At a yield strength of 185 ksi, none of the steels met the tentative minimum toughness (50 ft-lb at 0 F) for an HY-180/210 base metal. However, the 3Ni-Cr-Mo-Cb steel and the 0.22C 5Ni-Cr-Mo-V steel appear capable of meeting the toughness requirement at a yield strength of about 182 ksi in 1/2-inch-thick plates and of about 175 ksi in 4-inch-thick plates. (Author)

AD-604 877 Div. 17
OTS Prices: HC $1.00/MF $0.50

United States Steel Corp., Monroeville, Pa.
THE EFFECTS OF VACUUM-CONSUMABLE-ELECTRODE REMELTING ON THE PROPERTIES OF 12Ni-5Cr-3Mo STEEL.
Technical rept.,
by D. S. Dabkowski and L. F. Porter. 1 Jul 64, 42p
Contract NObs88540, Projs. 40 018 002 21, SS050 000, Task 1567
Unclassified report

Descriptors: (*Steel, Refining (Metallurgy)), (*Refining (Metallurgy), Vacuum), Melting, Electrodes, Nickel alloys, Chromium alloys, Molybdenum alloys, Chemical analysis, Mechanical properties, Miscrostructure, Metal plates, Forging, Rolling (Metallurgy), Toughness, Tensile properties, Controlled atmospheres.

A study was made to determine the effect of vacuum-consumable-electrode remelting on the chemical composition, mechanical properties, and microstructure of 12Ni-5Cr-3Mo steel, a comparison was made with steel from the same heat that was (1) air-melted, conventionally cast, and rolled; (2) air-melted, conventionally cast, upset-forged, and rolled; and (3) air-melted, conventionally cast, vacuum-consumable-electrode remelted, upset-forged, and rolled. The results indicated that vacuum-consumable-electrode remelting did not improve the properties of the 12Ni-5Cr-3Mo steel, but that special processing procedures such as upset forging markedly improved the notch toughness of the steel. (Author)

AD-604 878 Div. 17, 26, 31
OTS Prices: HC $3.00/MF $0.75

United States Steel Corp., Monroeville, Pa.
WELDING CHARACTERISTICS OF PRODUCTION 5Ni-Cr-Mo-V STEEL.
Technical rept.,
by L. P. Connor. 1 Jul 64, 60p
Contract NObs88540, Projs. 40 018 001 28, SR007 01 01, Task 853
Unclassified report

Descriptors: (*Steel, Welding), (*Welding, Steel), (*Submarine hulls, Welding), Welds, Metal plates, Nickel alloys, Chromium alloys, Molybdenum alloys, Vanadium alloys, Martensite, Toughness, Microstructure, Fracture (Mechanics), Hardness, Manganese alloys.

An 80-ton electric-furnace heat of 5Ni-Cr-Mo-V steel was produced for extensive evaluation. The evaluation included a two-phase welding study of (1) the base-metal weldability and (2) the fabricability in heavy sections of the production 5Ni-Cr-Mo-V steel. The results of the base-metal weldability study indicate that the 5Ni-Cr-Mo-V steel has adequate hardenability to form the desired tough martensitic weld-heat-affected-zone microstructure for a practical range of welding conditions. The energy absorption of the weld-heat-affected-zone microstructures ranged from 80 to 102 ft-lb at 0 F. The results also indicate that the 5Ni-Cr-Mo-V steel has a low susceptibility to weld-heat-affected-zone cracking. The 5Ni-Cr-Mo-V steel exhibited a

SOVIET ATTITUDES TOWARD MODERN AIR POWER,
by Raymond L. Garthoff. 29 Nov 54, 12p P-603
Unclassified report

Prepared for delivery at the annual meeting of the American Historical Association, Dec 54.

Descriptors: (*Attitudes, USSR), (*Air force, USSR), (*Weapon systems, Attitudes).

AD-604 619 Div. 18
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE IMPACT OF AIR POWER ON THE INTERNATIONAL SCENE, 1933-1940,
by Herbert S. Dinerstein. 29 Nov 54, 17p P-604
Unclassified report

Prepared for delivery at the annual meeting of the American Historical Association, Dec 54.

Descriptors: (*Attitudes, Europe), (*Air force, Europe), (*Weapon systems, Attitudes).

The paper discusses Western European attitudes toward air power between 1933 and 1940.

AD-604 624 Div. 18
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE COSTS OF ALTERNATIVE AIR BASE STOCKING AND REQUISITIONING POLICIES,
by J. W. Petersen and M. A. Geisler. 1955, 28p
P-611
Unclassified report

Descriptors: (*Air Force procurement, Logistics), (*Logistics, Costs), Mathematical models, Economics, Equations, Spare parts, Inventory management.

A mathematical and statistical study of the supply operations at a typical Air Force base is made. The objective of the study is to determine the effect upon support cost of different logistics policies, involving changes in safety level and requisitioning frequency. This effect is found to vary according to the price and demand rate of the item being considered, and the study indicates that large monetary savings can be realized by adopting different stocking and requisitioning policies dependent upon item demand and price. Thus, the study indicates that it is more economical to have items costing under $10 requisitioned from the depot every three or six months, rather than every month, even if obsolescence charges on base stocks are as high as 50 per cent per year. The study has also indicated that standby stockage of cheap (under $10), low demand items is desirable because the cost of such stockage tends to be less than the costs incurred by premium supply action when a demand for such an item arises. (Author)

AD-604 626 Div. 18, 32.
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
PSYCHOLOGICAL ASPECTS OF FOREIGN POLICY,
by Hans Speier and W. Phillips Davison. 15 Dec 54,
48p P-615
Unclassified report

This paper was prepared for the Industrial Coll. of the Armed Forces, Washington, D. C.

Descriptors: (*Foreign policy, Psychology), (*Psychological warfare, Theory), (*Propaganda, Public opinion), Cold war, Social communication, Economic warfare, Economics, Political science.

All major actions in international relations have psychological implications and can be psychologically sound or unsound. A foreign policy which is psychologically sound attempts to maximize the desirable effects of action and minimize the undesirable effects in such ways as the following: by taking account of the social and psychological characteristics of politically significant groups abroad; by considering questions of optimum timing and surprise in the light of these characteristics; by paying attention to the possibility of exploiting initial successes; or by permitting or not permitting another power to save face. In these and similar ways, the political strategist attempts to supplement military and economic power by taking advantage of existing social and psychological forces to influence the behavior of various individuals and groups abroad in a desired direction. (Author)

AD-604 662 Div. 18, 23, 26
OTS Prices: HC $5.00/MF $1.00

Assistant Secretary of Defense (Installations and Logistics), Washington, D. C.
THE MANAGEMENT OF VALUE ENGINEERING PROGRAMS IN DEFENSE CONTRACTS.
Training guide.
Apr 64, 170p
Unclassified report

Descriptors: (*Armed forces procurement, Management engineering), (*Management engineering, Costs), (*Department of Defense, Armed forces procurement), Government employees, Training, Personnel management, Industrial research, Industrial training, Industrial relations, Inventory analysis, Job analysis, Systems engineering, Instruction manuals, Engineering personnel.

Uniform instruction in value engineering program management for Department of Defense personnel is provided. The requirements of those who will be engaged in negotiating, reviewing and approving contractor value engineering efforts are listed. The fundamentals of the value engineering theory and details of value engineering program tasks are presented. Contractual aspects based upon the Armed Services Procurement Regulation are discussed in detail. Guidelines are offered for some of the administrative and operational facets of value engineering programs.

AD-604 663 Div. 18, 23, 26
OTS Prices: HC $6.00/MF $1.25

Assistant Secretary of Defense (Installations and Logistics), Washington, D. C.
PRINCIPLES AND APPLICATIONS OF VALUE ENGINEERING.
Training guide.
1964, 225p
Unclassified report

Descriptors: (*Armed forces procurement, Management engineering), (*Management engineering, Costs), (*Department of Defense, Armed forces procurement), Government employees, Training, Personnel management, Industrial research, Industrial training, Industrial relations, Systems engineering, Job analysis, Logistics, Instruction manuals.

The following objectives of this training guide are

18. Military Sciences and Operations

AD-604 385 Div. 18
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
IS DISPERSAL GOOD DEFENSE.
by Gershon Cooper and Roland N. McKean.
Rev. 15 Sep 54, 17p P-548
Unclassified report

Descriptors: (*Vulnerability, Nuclear warfare), (*National defense, United States), (*Nuclear warfare, United States), Economics, Population, Sociology.

The paper discusses the idea of dispersal as a national defense measure.

AD-604 400 Div. 18, 33
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
MINIMIZING THE NUMBER OF CARRIERS TO MEET A FIXED SCHEDULE,
by G. B. Dantzig andD. R. Fulkerson. 24 Aug 54, 13p P-569
Unclassified report

Descriptors: (*Scheduling, Transportation), (*Linear programming, Scheduling), Operations research. Optimization, Tankers, Logistics, Naval vessels (Support).

It is shown that the problem of determining the minimum number of carriers required to meet a fixed schedule of transportation can be made into a linear programming problem. (Author)

AD-604 491 Div. 18, 5, 28
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE USE OF WAR GAMES IN COMMAND AND CONTROL ANALYSIS,
by Milton G. Weiner. Oct 61, 13p P-2466
Unclassified report

Presented at the NATO Conference on Gaming and Simulation, Paris, France, Nov 61.

Descriptors: (*Command and control systems, Warfare), (*Warfare, Simulation), Nuclear warfare, Armed forces operations, Limited war, Control, Behavior, Game theory, Analysis.

An attempt to wed command and control operations to war games in order to understand the processes and problems of command and control is examined. It is concluded that this analysis of command and control provides a new use for war gaming studies. In it, the detailed, dynamic representation of the situation, complete with the fog of war and the human equation, are very important ingredients.

AD-604 509 Div. 18, 28, 32
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
COMMENTS ON AN ARTICLE BY CHAS. E. OSGOOD 'A PSYCHOLOGIST'S CURE FOR THE ARMS RACE',
by Amrom H. Katz. Nov 61, 7p P-2439
Unclassified report

Comment on article originally pub. in War/Peace Report, Nov 61.

Descriptors: (*Reviews, Arms control), (*Arms control, Reviews), Foreign policy, Deterrence, Cold war, Armament, National defense, Disarmament, United States, USSR, Periodicals, Psychology.

A psychologist's comments on arms control are reviewed. Problems concerning disarmament of the US and USSR are considered.

AD-604 572 Div. 18, 32
OTS Prices: HC $3.00/MF $0.50

Special Operations Research Office, American Univ., Washington, D. C.
UNCONVENTIONAL WARFARE.
Bibliography supplement no. 3,
by Nancy Ann Gardner. Jul 64, 56p SORO-RM-64-10
Unclassified report

Operating under contract with the Department of the Army.

Descriptors: (*Unconventional warfare, Bibliographies), (*Bibliographies, Unconventional warfare), Military strategy, Military tactics, Psychological warfare, History, Abstracting.

Contents: Fundamental elements of unconventional warfare (theory, strategy, legality, administrative matters, unconventional warfare operations, semi-conventional); Historical models of unconventional warfare in insurgencies (pre-World War I experience, World War I-1939 experiences, World War II experience, post-World War II experience).

AD-604 597 Div. 18
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
CONCEPTS OF LIMITED WAR: AN HISTORICAL APPROACH,
by H. A. DeWeerd. Nov 61, 21p P-2352
Unclassified report

Descriptors: (*Limited war, Communism), (*Communism, Limited war), Foreign policy, Cold war, Defense systems, Military strategy, Deterrence, History, Nuclear weapons, USSR, China.

The United States can and must maintain at least a condition of approximate strategic balance with the Soviet Union in the 1960's. If not, it is difficult to see how the United States can contest communist aggressions in the third areas of the world. This in turn will weaken and ultimately destroy the collective security system. The United States can and must maintain a limited war capability which will enable it to contest a fairly wide range of possible communist aggressions in the third areas of the world. It must maintain such a capability because it shall not be able to rely on its strategic forces to deal with limited aggressions in this period. (Author)

AD-604 618 Div. 18
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.

Descriptors: (*Armed forces maneuvers, Nuclear warfare), (*Nuclear warfare, Armed forces maneuvers), (*National defense, USSR).

The paper is a translation of an article which appeared in a recent issue of Red Star, the central organ of the Ministry of Defense of the USSR. It deals with the conduct of troops under atomic warfare conditions.

AD-604 787 Div. 18, 12, 20, 22.
OTS Prices: HC $2.00/MF $0.75

RAND Corp., Santa Monica, Calif.
THE ROLE OF SCIENCE AND TECHNOLOGY IN MODERN WAR,
by G. I. Pokrovskii. 5 Feb 58, 40p T-79
TT 64 71281
Unclassified report

Trans. of Vsesoyuznoe Obshchestvo po Rasprostraneniyu Politicheskikh i Nauchnykh Znanii. Seriya 4 (USSR) 1957, no. 29.

Descriptors: (*Weapons, Scientific research), (*Scientific research, USSR), (*Warfare, Scientific research), Satellites (Artificial), Nuclear weapons, Civil defense systems, Air defense systems, Nuclear powered vessels, Submarines, Guided missiles, Armed forces budgets, Celestial mechanics, Rockets, Astrophysics, Cybernetics, Logistics, Biological warfare, Medical research, Electronic equipment, Transportation, Communication systems.

The applicability of science and technology to modern warfare and military affairs is discussed. Soviet scientific achievements are viewed in terms of their role in the development of modern weapons and in contemporary warfare.

AD-604 806 Div. 18, 15, 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A MONTE CARLO MODEL OF AN AIR FORCE TYPE SUPPLY SYSTEM,
by H. W. Karr. 24 May 55, 6p P-683-A
Unclassified report

Descriptors: (*Monte Carlo method, Inventory control), (*Inventory control, Air Force equipment), (*Logistics, Models (Simulations)), Management engineering, Air Force operations, Operations research.

In the work at RAND on Air Force logistics, this tool of analysis has been applied to problems of Air Force inventory control and stock distribution using an IBM 701 computer. These problems are similar in many respects to the inventory and stocking problems in private industry and this paper is intended to give a very general description of one of these supply system models, in order to indicate the type of business inventory problems which can be studied by this method. (Author)

AD-604 849 Div. 18
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
LOGISTICS MODERNIZATION,
by Charles J. Zwick. Aug 64, 26p P-2955
Unclassified report

Descriptors: (*Logistics, Operations research), (*Air force equipment, Management control systems), (*Management control systems, Logistics), Weapons, Aircraft, Spare parts, Stock level control, Weapon systems, Management planning, Models (Simulations).

Modernization of a logistics system is discussed. New equipments and techniques which improve the effectiveness and efficiency of our logistics operations are described. Several features of modern weapon systems which have an important impact on the structure and operation of a modern logistics system are also considered.

AD-604 915 Div. 18, 23, 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
REMARKS ON THE DESIGN, CONDUCT, AND ANALYSIS OF LARGE AIR EXERCISES,
by N. C. Peterson. 16 May 55, 22p P-700
Unclassified report

Presented to the Operations Analysis Technical Conference (10th), Eglin Air Force Base, Fla., 10-11 May 55.

Descriptors: (*Air force operations, Military training), Air defense command, Air force personnel, Aircraft, Pilots, Communication systems, Group dynamics, Performance (Human), Air force research, Operations research, Military tactics, Research program administration, Test methods.

An analysis of operations research on Air force exercises is presented. The importance of adequate preparation, design, command and communication structures, and data collection is emphasized.

AD-604 918 Div. 18, 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
PROJECT RAND,
by F. R. Collbohm. 24 Mar 55, 14p P-707
Unclassified report

An address presented before the Scientific Advisory Board, Santa Monica, Calif., 24 Mar 55.

Descriptors: (*Air Force research, Research program administration), (*Scientific organizations, Air Force research), Operations research, Scientific research, Air Force budgets, Logistics, Air defense command, Systems engineering.

An analysis of the RAND corporation is presented. The development of the Air Force Research and Development program and its relationship with industry and science are described. The purpose of the program--scientific study and research on the broad subject of air warfare with the object of recommending to the Air Force preferred methods, techniques, and instrumentalities'-- is discussed.

AD-604 936 Div. 18
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
RECENT TRENDS IN SOVIET MILITARY POLICY,
by R. L. Garthoff. 30 Aug 55, 20p P-726
Unclassified report

Descriptors: (*Disarmament, USSR), (*Military strategy, USSR), Armed forces (Foreign), Government (Foreign), Deterrence, Cold war, Foreign policy, Economics, Defense systems, Armed forces budgets, Nuclear weapons.

provided: (a) a complete understanding of the fundamentals of the value engineering method, (b) a familiarity with some of the ancillary material necessary to its performance, and (c) a description of value engineering programs. Some material on value engineering program management is provided, such as contractual aspects, organization and assessment of results. The subject matter is presented in generic form.

AD-604 700 Div. 18, 23, 28
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
SYSTEMS BEHAVIOR. I. THE LEARNING PROCESS,
by Lawrence T. Alexander. Rev. 17 Oct 55, 5p
P-662
Unclassified report

Descriptors: (*Air defense command, Systems engineering), (*Group dynamics, Learning), (*Learning, Group dynamics), Behavior, Adjustment (Psychology), Aviation personnel, Performance (Human), Stress (Psychology), Defense systems.

Behavioral changes that occurred during the air defense experiments are discussed. Evidence that learning took place in the experiments is based on the occurrence of behavioral changes which enabled the air defense crews to deal with the task environment more adequately.

AD-604 713 Div. 18, 23, 32.
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE SOVIET HIGH COMMAND AND GENERAL STAFF,
by Raymond L. Garthoff. 27 May 55, 19p P-684
Unclassified report

Descriptors: (*Military organizations, USSR), (*Armed forces (Foreign), USSR), (*Political science, USSR), Officer personnel, Government (Foreign), Communists, Military strategy, Military personnel, Military government.

A discussion of the organization of Soviet Military forces is presented. The political and strategic problems facing the Soviet Union are also considered.

AD-604 725 Div. 18
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
BRITAIN AND THE DEFENSE OF WESTERN EUROPE,
by H. A. DeWeerd. 20 Jun 55, 35p P-697
Unclassified report

Descriptors: (*Defense systems, Western Europe), (*Great Britain, Defense systems), (*Military strategy, Great Britain), History, Government (Foreign), Armed forces (Foreign), Warfare, Public opinion, National defense, Poltical science, Nuclear warfare, Deterrence, Cold war, USSR, United States, Air Force operations, Air Defense Command.

The British attitude toward the concept of defending Western Europe and deterring aggression by means of an air-atomic weapons system and strategy is discussed.

AD-604 767 Div. 18, 20, 22
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
RED STAR SERIES ON ATOMIC WEAPONS AND ANTI-ATOMIC DEFENSE. PART II. ATOMIC WEAPONS AND ANTIATOMIC DEFENSE,
by B. Olisov. 1955, 10p T-41 pt. 2
TT 64 71261
Unclassified report

Trans. from Krasnaya Zvezda (USSR) 1954, 4 Aug, p. 2.

Descriptors: (*Nuclear weapons, Nuclear explosion damage), (*Nuclear warfare, Passive defense), Shielding, Pressure, Shock waves, Military personnel, Shelters, USSR.

The article discusses protection from shock waves in atomic attack.

AD-604 768 Div. 18, 20, 22
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
RED STAR SERIES ON ATOMIC WEAPONS AND ANTIATOMIC DEFENSE. PART III. ATOMIC WEAPONS AND ANTIATOMIC DEFENSE,
by B. Olisov. 1955, 10p T-41 pt. 3
TT 64 71262
Unclassified report

Trans. from Krasnaya Zvezda (USSR) 1954, 6 Aug, p. 2, See also AD-604 768.

Descriptors: (*Nuclear weapons, Nuclear explosion damage), (*Nuclear warfare, Passive defense), Fires, Burns, Contamination, Damage, Thermal radiation, Radiation damage, Shelters, Radiation injuries, USSR.

The article discusses the damaging effects of light and radioactive particles in atomic attack.

AD-604 775 Div. 18
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
RUSSIAN TACTICS,
24 Jul 53, 24p T-28
TT 64 71269
Unclassified report

Trans. of a German translation by the German Intelligence Section, Foreign Armies East of the German General Staff from the minutes of the Russian Theoretical Conference on Tactics of Kuks 'Wystrel' 1942.

Descriptors: (*Strategic warfare, USSR), (*Military tactics, USSR), Armed forces (Foreign), Military strategy, Ordnance, Artillery, Armament, Warfare, Military organizations, Defense systems.

Reports of Russian military tactics against Germany in 1942 are presented. The discussion is focused on the breakthrough problems involved in attack.

AD-604 784 Div. 18
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
CHATS ON THE ATOMIC WEAPON,
1954, 4p T-36
TT 64 71278
Unclassified report

Trans. from Krasnaya Zvezda (USSR) 1954, 3 Jul, p. 2.

THE VALUE OF AIRLIFT IN DEFENSIVE, LOCAL, OR PERIPHERAL WARS AFTER 1960,
by S. E. Eastman. 10 Feb 56, rev. 21 Feb 56, 20p P-803
Unclassified report

Descriptors: (*Air transportation, Military tactics), Armed forces transportation, Armed forces operations, Defense systems, Air defense command, Aerial warfare, Air force research, Tactical air command, Aerial warfare, Commercial planes, Costs, Military requirements, Logistics.

The value of airlift in the event of war and the establishment of military requirements for intercontinental air transportation are discussed. The example used relates solely to the United States Air Force. The time period selected, sometime after 1960, was chosen because of the long lead times on new transports currently under consideration for procurement by the military, because of the lead time involved in the kind of military operations commented upon, and for reasons of security.

AD-605 006 Div. 18, 32
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
NUCLEAR WEAPONS AND CHANGING STRATEGIC OUTLOOKS,
by Bernard Brodie. 27 Feb 56, 28p P-811
Unclassified report

Paper published in the February 1957 issue of the Bulletin of the Atomic Scientists.

Descriptors: (*Nuclear weapons, Military strategy), (*Military strategy, Nuclear weapons), Nuclear warfare, Political science, Foreign policy, Strategic warfare, Limited war.

AD-605 025 Div. 18
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
STRATEGY VERSUS TACTICS IN A NUCLEAR AGE,
by Bernard Brodie. 16 Apr 56, 28p P-841
Unclassified report

Descriptors: (*Military strategy, Political science), (*Military tactics, Political science), War, Nuclear warfare, Limited war.

AD-605 037 Div. 18
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
AIR FORCE LOGISTICS: SOME RECENT DEVELOPMENTS,
by Allen R. Ferguson. 3 May 56, 32p P-855
Unclassified report

Descriptors: (*Logistics, Air Force), (*Air force research, Logistics), Air transportation, Aerial warfare, Weapons, Defense systems, Tactical warfare, Aircraft, Air force budgets, Costs, Data processing systems.

Some aspects of Air Force logistics in which important new developments are underway are described. The increasing reliance upon airlift and other problems whose solution will largely determine the logistics posture of the Air Force in the next decade are discussed. The military environment and the functions of the logistics system in the early 1960's are outlined. The developments discussed are steps in making the logistics system capable of performing its functions in that environment, namely: introduction of improved logistics policies, the role of airlift, and how to maintain control over Air Force assets.

AD-605 040 Div. 18, 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
RAND RESEARCH ON A DATA-PROCESSING SYSTEM FOR THE UNITED STATES AIR FORCE,
by Murray A. Geisler. 7 May 56, 16p P-860
Unclassified report

Descriptors: (*Data processing systems, Logistics), (*Inventory control, Data processing systems), Stock level control, Computers, Air Force research, Data storage systems.

A description is given of a data processing system for use by the Air Force in inventory control.

AD-605 051 Div. 18, 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
WEAPONS SYSTEM PHILOSOPHY,
by George H. Clement. 27 Jul 56, 20p P-880
Unclassified report

Descriptors: (*Air defense command, Operations research), (*Weapon systems, Air force research), (*Defense systems, Air force research), Nuclear weapons, Logistics, Aircraft, Guided missiles, Communication systems, Control systems, Systems engineering, Armed forces operations, Strategic warfare, Aerial warfare, Costs.

The weapons system philosophy is discussed as a point of view embracing a technique for ordering, classifying and analyzing a technologically complex mechanism, organization or process. Each element and each problem is considered in its proper context so that the objectives of the system as a whole may be realized with a minimal expenditure of resources. The philosophy is considered to be a powerful tool aiding in the design, development and management of military weapons systems.

AD-605 060 Div. 18, 32
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
DISARMAMENT FAILURE AND WEAPONS LIMITATIONS,
by H. A. DeWeerd. 16 Jul 56, 22p P-896
Unclassified report

Descriptors: (*Control systems, Nuclear weapons), (*Disarmament, Nuclear weapons), (*Nuclear weapons, Disarmament), Foreign policy, Government (Foreign), Political science, History, Military strategy, Military intelligence, Cold war, United States government, USSR.

The American goal of complete nuclear disarmament is discussed. The major American proposals in the field of nuclear disarmament and limitations since 1946 are reviewed, and the causes for the failure of these proposals are examined. A policy of limitations on the use of nuclear weapons is suggested.

The announcement of the Soviet Union regarding the demobilization of its armed forces is discussed. The real objective of the reduction of ground forces is seen as a means of increasing over-all Soviet strength.

AD-604 943 Div. 18, 33
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
COMMENTS ON FUTURE MILITARY AIR TRANSPORT REQUIREMENTS,
by Samuel E. Eastman. 7 Sep 55, 8p P-734
Unclassified report

Speech before National Defense Transportation Association, 12 Oct 55, Boston, Mass.

Descriptors: (*Air transportation, Air force research), (*Logistics, Air force research), Costs, Armed forces supplies, Transport planes, Commercial planes, Armed forces transportation, Fleets, Aircraft.

The movement of passengers and cargo for the military establishment overseas is discussed. Costs of the operation as well as the availability of appropriate peacetime fleets in the event of war are examined.

AD-604 949 Div. 18, 23, 28, 30.
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE BACKGROUND AND IMPLICATIONS OF THE SYSTEMS RESEARCH LABORATORY STUDIES,
by Robert L. Chapman and John L. Kennedy.
21 Sep 55, 20p P-740
Unclassified report

Presented at the Air Force, National Research Council Scientific Symposium, Washington, D. C., 14-15 Nov 55.

Descriptors: (*Systems engineering, Applied psychology), (*Air defense command, Systems engineering), (*Group dynamics, Air defense command), (*Learning, Group dynamics), Models (Simulations), Stress (Psychology), Performance (Human), Adjustment (Psychology), Behavior, Motivation, Aviation personnel, Defense systems, Simulation, Training, Human engineering, Sociometrics, Social psychology, Air force research, Stress (Psychology).

The effective operation of complex man-machine systems was researched. In its laboratory studies of complete organizations the Systems Research Laboratory used a full-scale model of an air-defense direction center. One major result of this study was the development of techniques for using group learning in greatly improving system performance. In addition to a theoretical approach that can be used by other scientists, the results of this study have many implications for system design, especially in personnel selection and training and in human engineering.

AD-604 956 Div. 18, 28, 30.
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
COGWHEEL: A FILM STORY OF SYSTEMS RESEARCH LABORATORY'S ACTIVITIES,
by Robert L. Chapman and Milton G. Weiner.
21 Sep 55, 4p P-753
Unclassified report

Descriptors: (*Air defense command, Systems engineering), (*Systems engineering, Applied psychology), (*Group dynamics, Air defense command), Motion pictures, Air force personnel, Defense systems, Systems engineering, Performance (Human), Behavior, Learning, Simulation, Stress (Psychology).

'Cogwheel' is a 30-minute sound film that shows a 40-man Air Force crew operating an air-defense direction center in the Systems Research Laboratory at The RAND Corporation. It traces the development of the Cogwheel crew as an organization, illustrates the complexities of direction-center operations, brings out some of the problems of studying systems in a laboratory, and demonstrates the realism in human behavior and environment building that can be attained in laboratory studies of this kind.

AD-604 973 Div. 18, 32
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
PREDICTION OF POLITICAL ACTION BY MEANS OF PROPAGANDA ANALYSIS,
by Alexander L. George. 22 Dec 55, 30p P-779
Unclassified report

Descriptors: (*Propaganda, Military strategy), (*Military strategy, Propaganda), Government (Foreign), Communication systems, Public opinion, Foreign policy, Warfare, Weapons, History, Social sciences, Political science.

The problems of the wartime content analysts in predicting the initiatives of an opponent through analysis of his propaganda is described. It is selected for discussion here for two reasons: first, the methodological approach to this problem went through an interesting development in the course of the war; second, in addition to the obvious practical interest of this problem at the time, it has a certain theoretical interest as well, since it bears upon the general question of the relationship of communication and action in the relations between nations.

AD-604 980 Div. 18, 32
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE SOVIET APPROACH TO INTERNATIONAL POLITICAL COMMUNICATION,
by Paul Kecskemeti. 9 Jan 56, 28p P-788
Unclassified report

Descriptors: (*Psychological warfare, Political science), (*Propaganda, USSR), (*Foreign policy, USSR), Government (Foreign), Communism, Military strategy, Cold war, Communication systems, Social communications, Control.

Some of the distinguishing features of Soviet political communications are discussed. Certain characteristics of this body of international communications that have remained relatively constant at least since the consolidation of Stalin's dictatorship, in spite of changes in the propaganda line, are described. Some of these relatively constant characteristics have to do with formal properties of the channels through which the communications pass; others, with the role assumed by the communicator toward his audience and the objectives that he seeks to attain. In both these respects, Soviet communications differ considerably from political communications of non-Soviet origin.

AD-605 004 Div. 18, 33
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.

19. Navigation

AD-604 353 Div. 19, 9, 30, 33
OTS Prices: HC $2.00/MF $0.50

Naval Postgraduate School, Monterey, Calif.
MINIMAL-TIME SHIP ROUTING,
by W. E. Bleick and F. D. Faulkner. Aug 64, 32p
NPS,M RP46

Unclassified report

Descriptors: (*Navigation, Ships), (*Ships, Navigation), Ocean waves, Feasibility studies, Hydrodynamics, Velocity, Numerical analysis, Partial differential equations, Numerical methods and procedures, Programming languages, Computers, Least squares method.

A recent theory of minimal-time ship routing through time-dependent ocean wave height and direction fields is put to a numerical test by using a series of semidaily analyses furnished by the U. S. Navy Fleet Numerical Weather Facility. The interpolations and integrations required are found to be feasible. A resume of the theory is given. (Author)

AD-604 358 Div. 19, 8, 12
OTS Prices: HC $1.00/MF $0.50

Instrumentation Lab., Mass. Inst. of Tech., Cambridge.
NON-LINEAR SERVO DRIVE FOR A FLIMBAL,
by John Di Sorbo. Mar 59, 21p E-775
Contract AF04 645 9, Proj. 52156

Unclassified report

Descriptors: (*Gimbals, Servomechanisms), (*Servomechanisms, Gimbals), Drives, Circuits, Torque, Gyro stabilizers, Amplifiers, Switching circuits, Demodulators, Transistors, Diodes (Semiconductor), Servomotors, Silicon, Nonlinear systems, Stabilized platforms, Guidance.

Preliminary circuitry is described for a 'bang bang' servo such as might be used for a Flimbal or a conventional gimbal system. (Author)

AD-604 589 Div. 19, 6, 12
OTS Prices: HC $3.00/MF$0.75

Honeywell, Inc., St. Petersburg, Fla.
ANALYSIS OF THE APPLICATION OF IMAGE-FORMING PHOTOSENSORS TO WIDE FIELD-OF-VIEW DAYLIGHT STAR TRACKERS,
by Bartley F. Conroy. 20 Aug 64, 91p
[illegible]-Aero-11694-IR-3
Contract AF33 657 11694, Proj. 4200, Task 420016
AL TDR64 190

Unclassified report

Descriptors: (*Celestial navigation, Instrumentation), (*Star trackers, Inertial guidance), (*Tracking, Image tubes), Vidicons, Image orthicons, Photocathodes, Sky brightness, Light, Background, Noise, Detectors, Celestial guidance, Guided missiles, Images.

The report analyzes the performance limitations of wide field-of-view (approximately one degree by one degree) daylight startracking systems employing image-forming photosensors. The startracker was assumed to be an alignment reference for an inertial guidance system. Assumed system parameters are general enough to make results applicable to both air-and missile-borne applications, and to unrestricted operating altitudes. (Author)

AD-604 686 Div. 19
OTS Prices: HC $4.00/MF $0.75

Collins Radio Co., Cedar Rapids, Iowa
RADIOMETRIC INSTRUMENTATION TECHNIQUE STUDY.
May 64, 113p CRR-278
Contract AF33 616 8109, Proj. 8222, Task 82175
RTD TDR63 4228

Unclassified report

Descriptors: (*Microwave equipment, Radiometers), (*Space navigation, Radiometers), (Radiometers, Space navigation), Earth, Moon, Sun, Emissivity, Position finding, Radio receivers, Antennas, Thermal radiation, Tracking, Errors, Solar radiation, Atmosphere, Instrumentation.

The report considers the use of microwave radiometric equipment to determine the orientation of the line passing through the center of the moon, the earth, and the sun when the observation position is located in cislunar space. The errors in such determination are examined as a function of receiver/antenna parameters, operating wavelength, radial range of the receiver from the source body, and the thermal emission variations of the source. Because emphasis is on general applicability of radiometric instrumentation, servo errors are excluded from analysis. Considered are the electronic tracking errors, due to finite receiver threshold sensitivity, and the error due to equivalent emission center shift, caused by source emission variations. The latter error, in the case of moon tracking, is determined as a function of lunar phase and, in the case of earth tracking, is determined as a function of latitudinal, seasonal, and diurnal emission variations as well as emission variations due to solar activity. Also investigated were the transitional problems associated with wide variations of radial range from the source and the possibility of obtaining range information by a passive equipment. (Author)

AD-604 771 Div. 19
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE PERTURBATION OF PENDULUM AND GYROSCOPE INSTRUMENTS BY ACCELERATION OF THE VEHICLE,
by M. Schuler. 16 Jun 52, 16p T-24
TT 64 71265

Unclassified report

Trans. of Physikalische Zeitschrift (Germany) 1923, v. 24, no. 16, p. 344-350.

Descriptors: (*Perturbation theory, Gyroscopes), (*Gyroscopes, Perturbation theory), Acceleration, Gyro compasses, Instrumentation, Navigation, Differential equations, Motion, Oscillation, Germany.

AD-605 063 Div. 18, 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
WAR GAMING AS A TECHNIQUE OF ANALYSIS,
by Alexander M. Mood. 3 Sep 54, 14p P-899
Unclassified report

Descriptors: (*Game theory, Warfare), (*Warfare, Simulation), Operations research, Optimization, Decision theory, Armed forces operations, Military strategy, Military tactics, Standards, Computers, Analysis.

The technique of war gaming is modified to make it a method for solving problems previously thought to be beyond analysis and answerable only by appeal to the judgment of experts.

AD-605 078 Div. 18
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
IS 'DUAL' PREPAREDNESS MORE EXPENSIVE,
by Malcolm W. Hoag. 14 Aug 56, 10p P-922
Unclassified report

Descriptors: (*Armed forces budgets, Weapon systems), (*Strategic warfare, Weapon systems), (*Limited war, Weapon systems), (*Civil defense systems, Costs), Weapons, Strategic warfare, Air defense command, Defense systems, Economics, Aerial warfare, Military strategy, Nuclear warfare, Tactical warfare, Nuclear weapons.

The current debate over military budgets is discussed. The desirability of dual preparedness (the ability to fight limited wars without the superbomb as well as the ability to retaliate overwhelmingly with it) is considered. Claims that great political advantages accrue from being able to fight limited wars with old-fashioned means are examined.

AD-605 112 Div. 18, 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE LOGISTICS LABORATORY; HOPES AND PLANS,
by Murray A. Geisler. 9 Nov 56, 18p P-973
Unclassified report

Descriptors: (*Logistics, Laboratories), (*Air force research, Logistics), Operations research, Systems engineering, Data processing systems, Programming (Computers), Laboratory equipment, Simulation.

The development and functions of the Logistics Systems Laboratory are described. As part of the logistics research program at RAND, it provides for the development of improved logistics data handling, especially electronic computers. The laboratory is expected to provide a basically new research method, and will complement other research in the Logistics Department.

AD-605 118 Div. 18, 32
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
DETERRENCE IS NOT ENOUGH,
by G. C. Reinhardt. Rev. 4 Jun 58, 24p P-983
Unclassified report

Descriptors: (*Defense systems, Deterrence), (*Deterrence, Cold war), (*Political science, Deterrence), Communism, Nuclear warfare, Military strategy, Foreign policy, History, Strategic air command, Civil defense systems, USSR, United States government.

The value of a policy of deterrence in the nuclear era is discussed. The effectiveness of deterrence is examined by historical analogy as well as by a consideration of present-day political ideologies and their threat to world peace.

AD-605 119 Div. 18, 32
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE TRAGEDY OF HUNGARY: A REVOLUTION WON AND LOST,
by Raymond L. Garthoff. 28 Nov 56, 30p P-984
Unclassified report

Descriptors: (*Hungary, Counterinsurgency), (*Counter-insurgency, Hungary), (*Foreign policy, USSR), Government (Foreign), Communism, Armed forces (Foreign), Military government, Military personnel, Propaganda, Political science.

The Soviet decision to intervene with force and crush the revolution in Hungary in 1956 is discussed. The revolution had not only succeeded in Hungary, it had been taken by the Soviets as an unwanted but accepted fact by October 30. Then, in a moment of defiance, the Hungarian people and their leaders on October 31 drove beyond the point of possible Soviet acceptance and led the Soviet leaders to decide upon a course of military intervention and repression.

AD-605 123 Div. 18, 26, 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
SOME PRINCIPLES FOR A DATA-PROCESSING SYSTEM IN LOGISTICS,
by M. A. Geisler. 12 Dec 56, 24p P-991
Unclassified report

Descriptors: (*Data processing systems, Logistics), (*Logistics, Data processing systems), Air force operations, Maintenance, Supply depots, Vulnerability, Stock level control, Records, Standardization, Management control systems, Communication systems.

The paper discusses some of the principles and concepts of a revised logistics data processing system proposed for the Air Force. These ideas provide a general framework in which a data processing system might be developed that would be able to meet the operational needs of the 1960's. The ideas developed in the paper, although pointed particularly at the Air Force, might have relevance and use for the other military services and industry in general. (Author)

completeness, and no attempt has been made to evaluate the specific detection capabilities of the international detection system which was discussed at the Geneva political negotiations. Detection will be discussed separately for each environment in which explosions could be undertaken --- in the atmosphere, underwater, underground, and in space. The underground and space environments will be treated in greater detail than the atmosphere and underwater environments, since the more difficult problems for detection arise in the case of underground and space nuclear explosions. (Author)

AD-604 581 Div. 20
OTS Prices: HC $4.00/MF $0.75

Elementary Particles Lab., Princeton Univ.; N. J.
A STUDY OF DI-PION RESONANCES PRODUCED AT LOW MOMENTUM TRANSFER IN NEGATIVE PION + P YIELDS NEGATIVE PION + POSITIVE PION + N AT 1.6 BEV/c.
Technical rept. no. 35,
by Alan R. Clark. 28 Aug 64, 118p
Contract Nonr1858 06

Unclassified report

Doctoral thesis.

Descriptors: (*Pions, Nuclear reactions), (*Meson reactions, Nuclear resonance), Mass spectroscopy, Momentum, Proton reactions, Neutrons, Meson scattering, Meson cross sections, Nucleons, Absorption, Nuclear spins.

Spark chamber spectrometers were used to investigate the di-pion mass spectrum over the mass range 450 - 1000 MeV. The di-pions were produced in the reaction negative pion + p yields negative pion + positive pion + n at an incident momentum of 1.6 BeV/c. More than 600 events were obtained with a mass resolution of ± 4 MeV. The di-pion mass spectrum shows a strong contribution from the neutral RHO meson centered at approx. 740 MeV with a width on the order of 130 MeV. There is no evidence of any other structure in the spectrum. The data can be interpreted fairly well within the framework of the one pion exchange model (OPE), but the distributions of the Treiman-Yang angle and the pion-neutron effective masses indicate the presence of non-OPE processes. The distributions could be explained by the formation of a recently reported I = 1/2 pion-N state with a mass of 1.4 BeV. Comparisons with other measurements of the total cross section show a much larger resonant contribution to the data than expected from OPE; this effect can be explained by a depolarization of approx. 35% of the rho meson due to rho-N final state absorption.

AD-604 756 Div. 20
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
RED STAR SERIES ON THE PROBLEMS OF UTILIZING ATOMIC ENERGY. PT. VIII. THE USE OF RADIOACTIVE SUBSTANCES IN TECHNOLOGY,
by A. Nesmeyanov. 1955, 10p T-42 pt. 8
TT 64 71250

Unclassified report

Trans. from Krasnaya Zvezda (USSR) 1955, 13 Mar, p. 3, See also AD-604 760.

Descriptors: (*Radioactive isotopes, Industries), (*Nuclear industrial applications, Reviews), Measurement, Diffusion, Machines, Resistors, Metallurgy, USSR.

The article considers briefly the use of radioactive substances in such diversified problems as the following: the radioscopic examination of metallic articles of defects by means of the gamma-radiation from cobalt-60; the preparation of autoluminescent compounds; the automatic control of industrial processes such as regulating the flow of liquids and the thickness of metal sheets and foils; the preservation of foodstuffs by sterilization through irradiation; the manufacture of supersensitive measuring devices; the reduction in ignition delay time in radar gas-discharge tubes and the manufacture of high-value resistors; the use of the method of tagged atoms for determining wear in moving parts of mechanical devices such as piston rings in internal combustion engines and for studying the diffusion of various metallic components in alloys. (Author)

AD-604 759 Div. 20
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
RED STAR SERIES ON THE PROBLEMS OF UTILIZING ATOMIC ENERGY. PT. VI. THE ATOMIC INDUSTRY, 1,
by A. Komanov. 1955, 10p T-42, pt. 6
TT 64 71253

Unclassified report

Trans. from Krasnaya Zvezda (USSR) 1955, 11 Jan, p. 3, see also AD-604 761.

Descriptors: (*Nuclear reactors, Reviews), (*Isotope separation, Reviews), Belgium, Canada, England, United States, Plutonium, USSR, Uranium.

The article lists the geographical location of uranium ore processing plants in Belgium, Canada, England and the USA. Two photographs, which accompanied the original article, one of the Clinton Engineer Works at Oak Ridge, Tenn., and the other of the Hanford Engineer Works near Pasco, Wash., serve as the basis for a discussion of plants for the production of uranium 235 and of plutonium 239, respectively. The last quarter of the article is devoted to decrying the 'one-sided, exclusively military character' of the atomic industry in the USA.

AD-604 760 Div. 20
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
RED STAR SERIES ON THE PROBLEMS OF UTILIZING ATOMIC ENERGY. PT. VII. THE ATOMIC INDUSTRY, 2,
by P. Astashenkov. 1955, 10p T-42 pt. 7
TT 64 71254

Unclassified report

Trans. from Krasnaya Zvezda (USSR) 1955, 19 Jan, p. 2, see also AD-604 759.

Descriptors: (Nuclear power plants, Reviews), (*Isotope separation, Reviews), Plutonium, Uranium, Nuclear power plants, USSR.

AD-604 761 Div. 20, 21
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
RED STAR SERIES ON THE PROBLEMS OF UTILIZING ATOMIC ENERGY. PT. V. THE NUCLEAR FUEL ENGINE,
by G. Pokrovskii. 1955, 10p T-42 pt. 5
TT 64 71255

Unclassified report

Trans. from Krasnaya Zvezda (USSR) 1954, 15 Sep, p. 3, see also AD-604 762.

20. Nuclear Physics and Nuclear Chemistry

AD-604 338 Div. 20, 2
OTS Prices: HC $2.00/MF $0.50

Naval Research Lab., Washington, D. C.
FISSION PRODUCT RADIOACTIVITY IN THE AIR ALONG THE 80th MERIDIAN (WEST), 1957-1962.
Final summary rept.,
by L. B. Lockhart, Jr., R. L. Patterson, Jr., A. W. Sanders, Jr., and R. W. Black. 15 Jun 64, 44p
Contract AT49 7 13, Proj. RR004 02 42 5151
NRL 6104

Unclassified report

Descriptors: (*Atmosphere, Radiological contamination), (*Radiological contamination, Atmosphere), (*Fission product activity, Measurement), Air pollution, Radioactivity, Nuclear explosions, Beta particles, Radioactive isotopes, Strontium, Radiochemistry.

The report summarizes measurements of both gross beta activity and Sr(90) activity in the air at ground level along the 80th meridian during the period 1957 through 1962. More detailed results and interpretations are given for the collections of radioactivity made in 1962. Practically all of the gross beta activity encountered in the air of the Northern Hemisphere during the early part of 1962 and 80-90% of the Sr(90) activity resulted from debris produced in the USSR series of tests held in the fall of 1961. Beginning in the late summer a second large increment of fresh activity, primarily from the USSR tests (August-December 1962), intruded into the air at most of these sites. In the Southern Hemisphere the source of the Sr(90) activity was primarily pre-moratorium bomb debris from a stratospheric source until the initiation of testing by the United States at Christmas Island. From May throughout the remainder of 1962 these tests contributed the bulk of the Sr(90) except in the southernmost areas of Chile, where there was a gradual rise in the contribution of the fresh component. (Author)

AD-604 517 Div. 20
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
RED STAR SERIES ON ATOMIC WEAPONS AND ANTIATOMIC DEFENSE. PT. IV. UTILIZING THE PROTECTIVE PROPERTIES OF THE TERRAIN,
by A. Glushko. 25 Aug 54, 9p T-41, pt. 4
TT 64 71245

Unclassified report

Trans. from Krasnaya Zvezda (USSR) 1954, 25 Aug, p. 2.

Descriptors: (*Radiation hazards, Countermeasures), (*Nuclear explosions, Shelters), (*Shelters, Terrain), (*Terrain, Radiological warfare), Radioactivity, Radioactive fallout, Countermeasures, Military personnel, Shock waves, Armed Forces operations, Shielding, Site selection, Shelters, Nuclear explosions.

The article is concerned with the problems of ascertaining and utilizing as protection, in case of atomic attack, such properties of the terrain as the relief (differences in elevation), woods, buildings, and other local objects. It is concluded that the protective properties of the terrain can be ascertained only after a careful study of it, a good knowledge of the peculiarities of the relief which can resist the destructive action of an atomic explosion. Utilizing the protective properties of the terrain does not free troops from carrying on engineering work with respect to anti-atomic defense. Improvement of the protective properties of the terrain by building engineering structures must be carried out by troops uninterruptedly. This will raise the degree of their protection against atomic weapons, will promote the conduct of active combat operations.

AD-604 518 Div. 20
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
RED STAR SERIES ON ATOMIC WEAPONS AND ANTIATOMIC DEFENSE. PT. VI. DEACTIVATION OF CONTAMINATED TERRAIN,
by A. Glushko. 28 Aug 54, 9p T-41, pt. 6
TT 64 71246

Unclassified report

Trans. from Krasnaya Zvezda (USSR) 1954, 28 Aug, p. 2

Descriptors: (*Terrain, Radiological contamination), (*Radiation hazards, Countermeasures), Radioactivity, Radioactive fallout, Nuclear explosions, Soil mechanics, Military personnel, Protective clothing, Armed Forces operations, Health physics.

The article deals with specific methods to be used in the field for deactivating radioactively contaminated terrain.

AD-604 519 Div. 20
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
RED STAR SERIES ON ATOMIC ENERGY. PT. III. NUCLEAR REACTIONS,
by M. Mkrtychev. 10p T-35, pt. 3
TT 64 71247

Unclassified report

Trans. from Krasnaya Zvezda (USSR) 1954, 4 Mar, p. 3.

Descriptors: (*Nuclear reactions, Reviews), Artificial radioactivity, Fission, Nuclear reactors, Nuclear explosions, Radioactive elements, Thermonuclear reactions, USSR.

AD-604 532 Div. 20
OTS Prices: HC $4.00/MF $0.75

RAND Corp., Santa Monica, Calif.
DETECTION OF NUCLEAR EXPLOSIONS,
by R. Latter, R. F. Herbst, and K. M. Watson.
2 Aug 61, 108p P-2399

Unclassified report

In cooperation with The Lawrence Radiation Lab., Univ. of California, Berkeley and Livermore.

Descriptors: (*Nuclear explosions, Detection), (*Detection, Nuclear explosions), Atmosphere, Acoustics, Shock waves, Propagation, Electromagnetic waves, X-rays, Equations, Electric fields, Magnetic fields, Nuclear particles, Fission products, Underwater explosions, Underground explosions, Seismic waves, Earthquakes, Integrals, Ionization, Data.

The Geneva negotiations on the discontinuance of nuclear weapon tests have focused considerable scientific attention on the problem of detecting nuclear explosions. The present paper reviews the detection problem broadly, and describes in detail some of the more important aspects of the problem. There has been no attempt at

The utilization of atomic energy for industrial purposes in the USSR is discussed. The prospects for using atomic energy and radioactive substances for peaceful purposes are viewed as being beneficial to the Soviet economy.

AD-604 781 Div. 20
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
RED STAR SERIES ON ATOMIC ENERGY. PT. V. THE THERMONUCLEAR REACTION WITH HYDROGEN,
by M. Arkhipov. 1954, 10p T-35, pt. 5
TT 64 71275

Unclassified report

Trans. from Krasnaya Zvezda (USSR) 1954, 26 Mar, p. 3, See also AD-604 782.

Descriptors: (*Thermonuclear reactions, Hydrogen), (*Hydrogen, Thermonuclear reactions), (*Nuclear energy, Production), Nuclei, Nuclear bombs, Nuclear binding energy, USSR.

AD-604 782 Div. 20
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
RED STAR SERIES ON ATOMIC ENERGY. PT. IV. THE PHYSICS OF A NUCLEAR EXPLOSION,
by M. Arkhipov. 1954, 12p T-35, pt. 4
TT 64 71276

Unclassified report

Trans. from Krasnaya Zvezda (USSR) 1954, 20 Mar, p. 3.

Descriptors: (*Nuclear explosions, Theory), (*Nuclear energy, Nuclear reactions), Nuclear weapons, Uranium, Fission, Nuclear physics, USSR.

The physics involved in a nuclear explosion is explained. The chain reaction and release of energy in an atomic explosion are described.

AD-605 022 Div. 20
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE EFFECTS OF NEUTRON IRRADIATION ON REACTOR FUEL COMPOSITION AND REACTIVITY. Lecture notes,
by G. Safonov. 22 Feb 56, 28p P-838

Unclassified report

Descriptors: (*Reactor fuels, Neutron reactions), (*Neutron reactions, Reactor fuels), Reactor reactivity, Nuclear reactions, Decay schemes, Reactor operation, Uranium, Power reactors, Costs.

Topics include: the transmutation chains of nuclear fuel (approximate chains for reactor work, concentrations of chain nuclei as a function of irradiation); effects of irradiation on reactor reactivity (the concept of a 'design' reactor and 'design' operating conditions, the 'reactiveness' of fuel, examples of 'off-design' reactor operation); remarks on feed costs for U235, U238 burners.

AD-605 035 Div. 20, 18, 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
SOVIET ATOMIC POLICY,
by Melville J. Ruggles and Arnold Kramish. 23 May 56, 16p P-853

Unclassified report

Descriptors: (*Nuclear weapons, USSR), Nuclear bombs, Scientific research, History, Nuclear warfare, Propaganda, Government (Foreign), Foreign policy.

The early history of nuclear research and development in the USSR is discussed. Soviet policy regarding disarmament, publicity, and military potential involving nuclear weapons is considered.

AD-605 084 Div. 20
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
RESONANCE ESCAPE PROBABILITY IN NATURAL URANIUM AND H2O - D2O MIXTURES,
by George Safonov. 30 Aug 56, 18p P-931

Unclassified report

Descriptors: (*Reactor materials, Resonance escape probability), (*Resonance escape probability, Reactor materials), Uranium, Water, Heavy water, Mixtures, Reactor moderators, Deuterium.

RAND was engaged in a rather broad theoretical survey of homogeneous water-uranium reactors. The aim was to explore the critical nuclear parameters of simple one-region systems consisting of all those mixtures of the four ingredients, U235, U238, H2O and D2O, which may sustain a chain reaction. The end product was to be a series of maps which show the relative characteristics of the spectrum of water-uranium systems. This article describes part of the program. The calculational scheme employed, a review of rationalizations made, and some resonance escape results for mixtures of natural uranium and water with varying amounts of light and heavy components are given.

AD-605 120 Div. 20
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ENGINEERING TEST REACTORS WITH LARGE CENTRAL IRRADIATION CAVITIES,
by George Safonov. 1 Nov 56, 8p P-986

Unclassified report

Descriptors: (*Test reactors, Neutron flux), (*Neutron flux, Test reactors), (*Reactor cores, Test reactors), Reactor fuel plates, Reactor reflectors, Thermal properties, Neutron reactions, Reactor control.

It is shown that a cavity test reactor with some 4000 liters of central irradiation space may achieve MTR flux levels while operating with MTR fuel plates under established conditions. Only computed results of pertinent characteristics are given.

Descriptors: (*Nuclear propulsion, Reviews), Aircraft nuclear propulsion, Marine nuclear propulsion, Underwater propulsion, Surface propulsion, USSR.

The article is concerned with the application of atomic engines to submarines, aircraft, guided missiles and automobiles. It is suggested that atomic submarines could provide an excellent means of communication in the Arctic since they could travel unhindered under the ice where there is always a layer of unfrozen water. Although not yet used in aircraft, atomic engines have great significance for pilotless aviation, e. g., guided missiles, long-range rockets, and cargo- and passenger-towing aircraft, since there is no need for extremely heavy shielding around the nuclear power plant. With regard to automobile transport, the existence of a project is indicated which makes use of gaseous fissionable materials in an internal combustion type of engine. (Author)

AD-604 762 Div. 20
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
RED STAR SERIES ON THE PROBLEMS OF UTILIZING ATOMIC ENERGY. PART IV. THE NUCLEAR POWER STATION,
by I. Naumenko. 1955, 10p T-42 pt. 4
TT 64 71256

Unclassified report

Trans. from Krasnaya Zvezda (USSR) 1954, 11 Sep, p. 3, see also AD-604 763.

Descriptors: (*Nuclear power plants, Reviews), Energy conversion, Nuclear energy, Electricity, Thermocouples, Fission products, Shielding, Transistors, Nuclear reactors, Radioactive batteries, USSR.

In the first half of the paper the organization of a nuclear power station are examined, the difficulties associated therewith are discussed, and the advantages and disadvantages thereof by comparison with conventional thermal power stations are listed. In the second half of the paper, three methods for transforming atomic energy directly into electrical energy are briefly discussed: (a) by using thermocouples to generate a thermoelectric E M. F.; (b) by using the positive charge on nuclear fission fragments to develop a potential difference between two concentric spherical shells and thus generate an E. M. F.; and (c) by using the electron voltaic effect induced in transitors by beta-particle bombardment. (Author)

AD-604 763 Div. 20
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
RED STAR SERIES ON THE PROBLEMS OF UTILIZING ATOMIC ENERGY. PART III. NUCLEAR REACTORS,
by M. Arkhipov. 1955, 10p T-42 pt. 3
TT 64 71257

Unclassified report

Trans. from Krasnaya Zvezda (USSR) 1954, 7 Sep, p. 3.

Descriptors: (*Nuclear reactors, Reviews), Heterogeneous reactors, Homogeneous reactors, Neutron absorbers, Construction, Operation, Nuclear power plants, USSR.

The present paper is the third in this series. It discusses briefly the problems connected with the construction, operation and application of heterogeneous and homogeneous nuclear reactors.

AD-604 764 Div. 20, 18
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
RED STAR SERIES ON ATOMIC WEAPONS AND ANTIATOMIC DEFENSE. PART I. ATOMIC WEAPONS AND ANTIATOMIC DEFENSE,
by B. Olisov. 1955, 10p T-41 pt. 1
TT 64 71258

Unclassified report

Trans. from Krasnaya Zvezda (USSR) 1954, 3 Aug, p. 2.

Descriptors: (*Nuclear weapons, Public opinion), (*Nuclear warfare, Defense systems), Ordnance, Nuclear bombs, Nuclear explosions, Foreign policy, USSR.

AD-604 778 Div. 20
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
RED STAR SERIES ON ATOMIC ENERGY. PT. XI. THE PHYSICS OF THE BEHAVIOR OF NUCLEAR FORCES IN THE ATMOSPHERE AND AT SEA,
by G. Pokrovskii and M. Arkhipov. 1954, 10p
T-35 pt. 11
TT 64 71272

Unclassified report

Trans. from Krasnaya Zvedzda (USSR) 1954, 4 Jun, p. 3, see also AD-604 779.

Descriptors: (*Nuclear explosions, Nuclear forces), (*Nuclear explosion damage, Atmosphere), Underwater explosions, Shock waves, Light, Seas, Propagation, USSR.

AD-604 779 Div. 20
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
RED STAR SERIES ON ATOMIC ENERGY. PT. VII. THE PHYSICS OF THE BEHAVIOR OF NUCLEAR FORCES (THE SHOCK WAVE),
by G. Pokrovskii. 1954, 11p T-35, pt. 7
TT 64 71273

Unclassified report

Trans. from Krasnaya Zvezda (USSR) 1954, 6 May, p. 3, see also AD-604 780.

Descriptors: (*Nuclear energy, Shock waves), (*Nuclear explosions, Shock waves), (*Shock waves, Physics), Nuclear forces, USSR.

AD-604 780 Div. 20, 32
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
RED STAR SERIES ON ATOMIC ENERGY. PT. VI. ATOMIC ENERGY IN THE SERVICE OF THE NATIONAL ECONOMY,
by V. Mikhailov and M. Mkrtychev. 1954,
10p T-35, pt. 6
TT 64 71274

Unclassified report

Trans. from Krasnaya Zvezda (USSR) 1954, 7 Apr, p. 3.

Descriptors: (*Nuclear industrial applications, USSR), (*Nuclear energy, Economics), (*Economics, Nuclear energy), Radioactivity, Industries, Uranium, Production, Aircraft, Nuclear powered vessels, Submarines, Fuels, Rockets, Reports.

22. Ordnance

AD-604 499 Div. 22
OTS Prices: HC $2.00/MF $0.50

High Velocity Lab., Univ. of Utah, Salt Lake City.
INVESTIGATION OF AN ARC GUN,
by T. Fujii, E. P. Palmer, and R. W. Grow.
3 Aug 60, 49p UU-6
Contract AF04 647 176
AFBMD TR60 217

Unclassified report

Descriptors: (*Electric guns, Light gas guns), (*Hypervelocity guns, Light gas guns), (*Light gas guns, Electric arcs), Firing mechanisms (Weapon), Gun components, Lithium compounds, Hydrides, Nylon, Pellets, Projectiles, Propellants, Trigger circuits, Energy conversion, Capacitors.

To satisfy needs for a superior hypervelocity gun, a study was made of the possibility of converting the electrical energy in a capacitor bank to kinetic energy of a projectile through the use of an electric arc discharge in a gun chamber. An arc gun was developed consisting of a chamber with a pair of electrodes and an accelerating barrel. To operate the gun, the chamber is packed with lithium hydride and the barrel is fitted with a nylon pellet. The capacitor bank is discharged into the chamber, causing conversion of the lithium hydride into a low-molecular gas. The expansion of the light gas accelerates the pellet. With a 30 microfarad capacitor bank charged to 17 kilovolts, a 3.7 milligram nylon projectile was accelerated to 5.0 kilometers per second. The efficiency of the energy conversion from the capacitor to the arc was 58.2 per cent, and the efficiency of the energy conversion from the arc to the projectile was 1.82 per cent. The total efficiency of the energy conversion from the capacitor to the projectile was 1.1 per cent. (Author)

AD-604 600 Div. 22, 2, 20
OTS Prices: HC $1.25/MF $0.50

Army Engineer Research and Development Labs., Fort Belvoir, Va.
SUBSURFACE ACCELERATIONS AND STRAINS FROM AN UNDERGROUND DETONATION, PART II,
by F. A. Pieper, A. C. Tiemann, and R. H. Sievers, Jr.
Oct 58, 55p
Proj. 26 4e
WT 1531

Unclassified report

WT-1529

Descriptors: (*Underground explosions, Explosion effects), (*Nuclear explosions, Explosion effects), (*Structural geology, Underground explosions), Stratigraphy, Rock (Geology), Motion, Acceleration, Strain (Mechanics), Pressure, Stresses, Test equipment.

The objectives of the project were to measure transient and residual ground motion from Shot RAINIER, Operation PLUMBBOB. The measurements consisted of acceleration, pressure, stress, strain, and permanent displacement in the free field below the floor of the main entrance tunnel. (Author)

AD-604 693 Div. 22, 28, 30
OTS Prices: HC $4.00/MF $1.00

Ohio State Univ., Columbus. Engineering Experiment Station.

VIBRATIONS OF A MULTI-WHEELED VEHICLE.
Technical rept.,
by Dale R. Bussman. 30 Aug 64, 142p RF-573-64-1(U)
Contract DA15 014AII2965

Unclassified report

Descriptors: (*Armored vehicles, Vibrations), Vehicles, Military requirements, Maneuverability, Terrain, Military personnel, Fatigue (Physiology), Test methods, Mathematical models, Statistical analysis, Ordnance.

The main objective of this analysis is to predict the limiting cross-country speed as a function of the vehicle's design parameters, the terrain geometry, and the crew's tolerance to the various accelerations. There are basically two types of information which are of importance in this analysis. They are (1) information concerning motion of the vehicle at each instant of time and (2) statistical information about the motions over long time periods. Obviously each category can be important. Knowing the motions as a function of time, it is possible to determine maximum motions. Also it may be possible with this type of information to select suspension components such that motions are minimized. With a statistical analysis, such quantities as mean-squared motions and the probability of accelerations exceeding some specified value can be determined. It is conceivable that both deterministic and statistical information will be required by the physiologist to specify the human tolerance level. Hence, this report presents analyses for both deterministic and random terrains. (Author)

AD-605 002 Div. 22, 2
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
APPLICATION OF THE BALDWIN CRATER RELATION TO THE SCALING OF EXPLOSION CRATERS,
by J. E. Hill and J. J. Gilvarry. 27 Jan 56, 36p P-801

Unclassified report

Descriptors: (*Explosion effects, Cratering), (*Cratering, Scale), Surface burst, Soil mechanics, Explosive materials, Meteors, Impact shock, Moon, Terrain.

Baldwin has demonstrated that the curve of diameter vs depth for craters due to surface explosions on the earth shows a continuous variation through the analogous curve for the terrestrial meteoritic craters into the corresponding curve for lunar craters; the latter two classes of craters are presumed due to explosions associated with meteoritic impact. The conventional (cube-root) method of scaling dimensions of an explosion crater from a prototype crater for different energy releases, by which diameter and depth are each taken proportional to the 1/3 power of the energy, is shown to be inconsistent with the empirical Baldwin relation. Two methods for scaling craters due to surface explosions of high energy are developed which are consistent with the Baldwin relation and preserve different features of cube-root scaling; in one the crater volume is taken proportional to energy release, and in the second the scaling exponent for the diameter is set equal to 1/3. A comparison of the two scaling methods with experimental data is carried out; available data do not permit a choice between the two methods. The results permit one to assign an energy scale to the terrestrial meteoritic and the lunar craters. (Author)

AD-605 113 Div. 22
OTS Prices: HC $4.00/MF $0.75

RAND Corp., Santa Monica, Calif.

21. Nuclear Propulsion

AD-604 773 Div. 21, 1
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ON AN ATOMIC AIRPLANE,
by V. Artamkin. 14 Oct 58, 10p T-106
TT 64 71267 Unclassified report

Trans. of Atomnaya Energiya (USSR) 1958, v. 4, no. 4, p. 389-391.

Descriptors: (*Aircraft nuclear propulsion, Reviews), Nuclear reactors, Airborne, Design, USSR.

A review of the non-Soviet Literature concerning nuclear powered aircraft design efforts.

23. Personnel and Training

AD-604 438 Div. 23, 28
OTS Prices: HC $3.00/MF $0.75

Applied Psychological Services, Wayne, Pa.
POST-TRAINING PERFORMANCE CRITERION DEVELOPMENT AND APPLICATION. FURTHER EXPLORATION AND POINTS-OF-VIEW ANALYSIS OF THE JOB OF THE NAVAL AVIATION ELECTRONICS TECHNICIAN,
by Arthur I. Siegel, Mark G. Pfeiffer, and Douglas G. Schultz. Jul 64, 60p
Contract Nonr2279 00

Unclassified report

Descriptors: (*Personnel management, Naval personnel), (*Job analysis, Naval personnel), (*Electronic technicians, Job analysis), Performance (Human), Attuitudes, Perception (Psychology), Applied psychology, Aviation personnel, Technicians, Officer personnel, Group dynamics, Factor analysis, Statistical analysis, Correlation techniques, Electronic equipment, Psychometrics.

On the basis of a multidimensional scaling analysis of the job task perceptions of striker and petty officer, third class aviation electronics technicians, four basic factors were extracted. These factors, called 'electro-comprehension,' 'equipment operation and inspection (routine)', 'electro-repair (simple)', and 'electro-safety' were held to be 'congruent' with the factors extracted from a similar analysis of the perceptions of aviation electronic technician supervisory personnel. Thus, it was concluded that the job perceptions of personnel at both the supervisory and the subordinate levels are in reasonable concordance. (Author)

AD-604 451 Div. 23, 30.
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
SECONDARY SCHOOLS AND COMPUTING,
by Fred Gruenberger. Nov 61, 5p P-2483

Unclassified report

Descriptors: (*Education, Computers), (*Computers, Education), (*Programming (Computers), Education), Coding, Learning, Computer operators, Computer personnel, Training.

The introduction of computing technology and the computers themselves into our secondary schools stands a good chance of being orderly. (1) Courses will be given under the sponsorship of the mathematics or science departments. (2) Suitable textbooks will be available. (3) The instructors will be trained. (4) The machines used, though probably old, will be massproduced, with a wealth of software behind them. In addition, each teacher can seek expert help, if needed, from local industry. The real wave of such courses will probably not come until 1963 or later. For one thing, an introduction to computing might properly belong at the secondary school level--there seems to be a strong analogy to the learning of a foreign language and it has become obvious that the latter subject is best taught to the young. For another thing, since computing skills cut across every discipline, we can reason that we owe it to the college-bound student to prepare him for intelligent use of this tool prior to his college freshman year.

AD-604 453 Div. 23, 30.
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
RAND'S GRADUATE STUDENT PROGRAM AS A MEANS OF SELECTING COST ANALYSTS,
by J. W. Noah. Sep 62, 8p P-2638

Unclassified report

Descriptors: (*Professional personnel, Selection), (*Personnel management, Professional personnel), Economics, Education, Costs, Training, Manpower studies, Research program administration, Students, Budgets.

The RAND Graduate Student Program offers a partial solution to the problems associated with hiring new and untrained personnel. The graduate student selected for the program is usually one of the top Ph.D. candidates at his respective school. He is treated much the same as new men joining our staff on a full-time basis. He works on a problem of individual research based on his area of interest and specialty and on RAND's interest, and which hopefully can be completed during the summer period. The idea behind the program is to interest qualified graduate students in full-time employment after graduation, and to allow RAND to observe the capabilities of the candidate firsthand prior to offering him permanent employment. I think it not premature to say that RAND's Graduate Student Program has already proven to be worthwhile, and especially worthwhile to the Cost Analysis Department. The projects worked on this summer by our summer students represent a direct contribution to our research program. The amount of supervisory time given to these students has not been a problem; on the contrary, it has been enlightening. Success of such a program depends in large part upon management's willingness to view it as a long-range capital investment with a continuing commitment.

AD-604 529 Div. 23, 28
OTS Prices: HC $2.00/MF $0.50

American Inst. for Research, Palo Alto, Calif.
DISTINGUISHING ERRORS OF MEMORY FROM ERRORS OF UNDERSTANDING BY MEANS OF SELF-INSTRUCTIONAL TESTS.
Technical rept. no. 9,
by Wayne A. Hershberger. Aug 64, 47p
AIR-C28-8/64-TR
Contract Nonr3077 00

Unclassified report

Descriptors: (*Teaching machines, Learning), (*Memory, Teaching machines), Psychometrics, Recall, Retention, Feedback, Test methods, Education, Students, Training devices, Analysis of variance.

This study compared two types of self-instructional tests used as adjuncts to an expository text. One type of test (Pure Self-Test) incorporated two types of items, one assessing and remedying errors of memory and the other assessing and remedying errors of understanding. The other type of self-instructional test (Mixed Self-Test) was composed of a single type of complex question requiring answers involving memory plus understanding; remedial feedback was likewise mixed. Forty-eight high school sophomores were divided into three groups: One group studied the expository text alone (Basic Text Group), one studied the text plus the Pure Self-Test, and one studied the text plus the Mixed Self-Test. Five days later, each group was given a criterion test composed of the two self tests sans answers. There were no significant differences among groups on total criterion test scores, but the Pure Self-Test Group did best on the pure items and the Mixed Self-Test Group did best on the mixed items. The Basic Text Group did well on the pure recall items, fair on the mixed, recall-and-memory items but poorly on the pure understanding items. The generality of these findings is limited by the fact that none of the three lesson formats were highly effective. (Author)

A CALCULATION OF THE BLAST WAVE FROM A SPHERICAL CHARGE OF TNT,
by Harold L. Brode. 26 May 58, 102p P-975
Unclassified report

Descriptors: (*TNT, Shock waves), (*Shock waves, TNT), Detonation waves, Explosion effects, Explosion gases, Explosive materials, Pressure, Temperature, Velocity, Energy, Numerical analysis, Equations.

The blast wave from the detonation of a spherical charge of TNT is described based on results of a numerical calculation. The equations of motion and the equations of state for TNT and for air are described. The pressures, densities, temperatures and velocities are detailed as functions of time and radius. Space-time relations, and energy and impulse histories are shown. A second shock is seen to originate as an imploding shock following the inward rarefaction into the explosion product gases and a series of subsequent minor shocks are seen to appear in a similar manner, moving out in the negative phase behind the main shock. (Author)

(5) Computation, for each job, of an attribute score for each attribute (this score was based on the attribute weights for the various items of the Worker Activity Profile as multiplied by the item value for the job, with these cross-product values summed across all items that were analyzed as being applicable to the job). (Author)

AD-604 554 Div. 23, 28
OTS Prices: HC $2.00/MF $0.50

Occupational Research Center, Purdue Univ., Lafayette, Ind.
THE EXPERIMENTAL USE OF DIMENSIONS OF WORKER-ORIENTED JOB VARIABLES IN DETERMINING JOB REQUIREMENTS.
Rept. no. 6,
by George C. Thornton and Ernest J. McCormick.
Jul 64, 37p
Contract Nonr1100 19

Unclassified report

Descriptors: (*Factor analysis, Manpower studies), (*Job analysis, Industrial psychology), (*Personnel, Industrial psychology), Naval personnel, Aptitude tests, Motor reactions, Correlation techniques, Performance (Human), Behavior, Psychometrics, Labor.

Three different procedures were used for deriving 'attribute indices' for job factors, these attribute indices being derived for 14 different aptitudes, motor abilities, and physical capacities. These attribute indices, in turn, were used experimentally in two phases of the study. In one phase they were correlated with worker trait requirements of 401 jobs as published by the U. S. Employment Service. These published job requirements were given for the same attributes. The correlations were all significant, and of essentially the same magnitude, as those obtained in the previous study (in which the 162 items were treated individually). In the second phase, the indices of four attributes were derived for 43 Naval ratings (jobs). These, in turn, were correlated with test validity coefficients from 125 test validation studies with these 43 Naval ratings. This analysis resulted in significant relationships for most of the tests and subtests. The results of this analysis were generally more positive than a corresponding type of analysis in the previous study of 140 varied industrial jobs for which published validity data were available. In general, the results of this study lend encouragement to the possibility of being able to establish job requirements through what are essentially job analysis procedures. (Author)

AD-604 580 Div. 23
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
WHAT TO DO ABOUT TEACHER SHORTAGES,
by Roland N. McKean and Joseph A. Kershaw.
Nov 61, 16p P-2458

Unclassified report

Descriptors: (*Education, Wages), (*Instructors, Wages), Training, Job analysis, Economics, Professional personnel, Background, Budgets.

Today most districts have unified salary schedules, which provide for only two kinds of pay differentials. They provide one set of salary steps for years of teaching experience and another set of steps for total amount of college credits. We urge that communities consider the adoption of a third set of steps for types of training -- so that district officials can offer higher salaries for some kinds of training without simultaneously being compelled to pay higher salaries for all teaching skills. Outside the teaching profession, there are wide salary differentials for various types of training. Average incomes in 1959 were $14,000 in the medical sciences, $11,000 in physics, and $8,000 in meteorology. Similarly, income variations exist for lawyers and ministers having the same amount of education and experience. In other words, it is characteristic of these professions and of professions generally not to have unified salary schedules. Is teaching different from other professions so that it requires an unprofessional salary structure. We think not, and we believe communities should no longer accept uncritically that kind of salary schedule.

AD-604 605 Div. 23, 28, 30
OTS Prices: HC $3.00/MF $0.75

Training Research Lab., Univ. of Illinois, Urbana.
TEACHING MACHINES AND COMPUTER-BASED SYSTEMS.
Technical rept. no. 1 (Revised draft),
by Lawrence M. Stolurow and Daniel Davis.
May 64, 66p
Contract Nonr3985 04

Unclassified report

Descriptors: (*Teaching machines, Computers), (*Training devices, Teaching machines), Feedback, Behavior, Reaction (Psychology), Programming (Computers), Dynamic programming, Learning, Effectiveness, Design, Analysis, Education.

The purpose of this paper is to develop a general model of the teaching process as accomplished by an adaptive teaching machine system. No attempt is made to completely inventory existing equipment or to describe particular machines in great detail.

AD-604 853 Div. 23, 18, 30
OTS Prices: HC $3.00/MF $0.50

RAND Corp., Santa Monica, Calif.
STUDIES IN DATA SYSTEM DEVELOPMENT: THE AIR RESERVE RECORDS CENTER,
by S. L. Pollack. Jul 64, 74p RM-4188-PR
Contract AF49 638 700

Unclassified report

Descriptors: (*Data processing systems, Personnel management), (*Personnel management, Data processing systems), Armed forces reserves, Personnel, Records, Systems engineering, Programming (Computer).

During its development and implementation, the electronic data processing system of the Air Reserve Records Center (ARRC) encountered many problems that other large-scale systems have faced or will face. This Memorandum describes solutions to some of these problems and explains several unique and worthwhile features that were incorporated into the Records Center's system. The study first describes the background for the development of the system, including the major steps leading to the current electronic data processing system. It then discusses the special features of the data system, and finally compares what was proposed early in the development with the current system. (Author)

AD-604 550 Div. 23, 28
OTS Prices: HC $1.00/MF $0.50

Occupational Research Center, Purdue Univ., Lafayette, Ind.
AN INVESTIGATION OF THE USE OF WORKER-ORIENTED JOB VARIABLES IN JOB EVALUATION.
Rept. no. 7,
by Joseph E. Champagne and Ernest J. McCormick.
Jul 64, 19p
Contract Nonr1100 19

Unclassified report

Descriptors: (*Wages, Job analysis), (*Job analysis, Wages), Personnel management, Labor, Industries, Factor analysis, Correlation techniques, Personnel, Industrial psychology.

This study was carried out to explore the extent to which current pay rates of jobs can be predicted on the basis of worker-oriented job variables. For this purpose the Worker Activity Profile (Gordon and McCormick, 1963) was used. It consists of 162 job activities of a check-list or rating scale nature that can be used in analyzing any job. The check-list items have numerical values of 0 and 1, and the rating-scale items values of 1 to 7. A sample of 253 jobs was used in this study; these jobs were selected because national wage or salary data had been published for them by the Bureau of Labor Statistics. The national (weighted) average rates of pay for these jobs were used as a criterion. The total sample was divided into an experimental sample (154 jobs) and a hold-out sample for cross-validation (99 jobs). Analyses with the experimental group were carried out to identify the items of the Worker Activity Profile which were related to rates of pay. Three combinations and weightings of such items were then used with the hold-out sample. While the three cross-validation procedures resulted in significant correlations, they were of only moderate size. For example, seven items, with statistical weights, gave a correlation with pay rates of .36. Various factors which might serve to attenuate the magnitude of the relationship were discusses. (Author)

AD-604 551 Div. 23, 28
OTS Prices: HC $2.00/MF $0.50

Occupational Research Center, Purdue Univ., Layfayette, Ind.
FACTOR ANALYSES OF WORKER-ORIENTED JOB VARIABLES.
Rept. no. 4,
by Joseph William Cunningham and Ernest J. McCormick.
Jun 64, 45p
Contract Nonr1100 19

Unclassified report

Descriptors: (*Job analysis, Industrial psychology), (*Personnel, Industrial psychology), (*Factor analysis, Manpower studies), Personnel management, Statistical analysis, Correlation techniques, Behavior, Performance (Human), Classification, Psychometrics, Labor.

The present report concerns a further investigation of the dimensions of worker-oriented job variables through use of the Worker Activity Profile (WAP). In this study, factor analyses similar to Gordon and McCormick's were conducted, using a job sample based on percentages of people within various occupational areas. The resulting factors were then compared with Gordon and McCormick's by use of the coefficient of congruence. The results of six separate factor analyses of WAP item groups were judged to be generally meaningful. Of the 32 factors obtained in this study, 16 were classified as comparable to factors from Gordon and McCormick's study, two others appeared from inspection to be similar to two of their factors, and eight factors showed a noticeable relationship with factors obtained by Gordon and McCormick. It was concluded that there are fairly stable and meaningful dimensions of jobs that characterize work in worker-oriented terms. These dimensions are sufficiently structures so that they emerge through factor analysis despite differences in the choice of bases for job samples used. (Author)

AD-604 552 Div. 23, 28
OTS Prices: HC $3.00/MF $0.75

Occupational Research Center, Purdue Univ., Lafayette, Ind.
THE DEVELOPMENT, ANALYSIS, AND EXPERIMENTAL APPLICATION OF WORKER-ORIENTED JOB VARIABLES.
Rept. no. 8 (Final),
by Ernest J. McCormick. Jul 64, 70p
Contract Nonr1100 19

Unclassified report

Descriptors: (*Job analysis, Industrial psychology), (*Factor analysis, Manpower studies), (*Personnel, Industrial psychology), Personnel management, Behavior, Classification, Performance (Human), Correlation techniques, Psychometrics, Labor.

This report summarizes a series of exploratory studies relating to worker-oriented job variables. These variables include worker behaviors in jobs and certain job context variables (situational and environmental) that have relevance to human work, as contrasted with job-oriented variables that deal more with the technological aspects of jobs. It is postulated that human work can be characterized in terms of either type of variable. However, for purposes of establishing common denominators across jobs of varied technological types, one must describe jobs more in terms of human behaviors and related variables (what are referred to here as worker-oriented variables).

AD-604 553 Div. 23, 28
OTS Prices: HC $2.00/MF $0.50

Occupational Research Center, Purdue Univ., Lafayette, Ind.
THE EXPERIMENTAL USE OF WORKER-ORIENTED JOB VARIABLES IN DETERMINING JOB REQUIREMENTS.
Rept. no. 5,
by Joseph William Cunningham and Ernest J. McCormick.
Jul 64, 28p
Contract Nonr1100 19

Unclassified report

Descriptors: (*Factor analysis, Manpower studies), (*Personnel, Industrial psychology), (*Job analysis, Industrial psychology), Behavior, Labor, Performance (Human), Psychometrics, Personnel management, Aptitude tests, Personality, Motor reactions, Correlation techniques.

This study was carried out in order to explore the possibility of the establishment of job requirements. The procedures followed in this study involved the development, for each job, of attribute scores for various human attributes. These were derived as follows: (1) Identification of attributes to be used (42 were selected for this purpose). (2) Rating of each activity of the Worker Activity Profile in terms of the degree to which each such attribute would be required. (3) Derivation of an attribute weight for each attribute on each item of the Worker Activity Profile (a single value for each attribute was derived from the several corresponding ratings). (4) Analysis of each job (in a sample of jobs) using the Worker Activity Profile.

25. Physics

AD-604 329 Div. 25, 14
OTS Prices: HC $2.00/MF $0.50

Redstone Scientific Information Center, Redstone Arsenal, Ala.
A PURELY OPTICAL METHOD FOR THE DIRECT MEASUREMENT OF MOMENTS IN THIN BENT PLATES, by Henry Favre and Bernhard Gilg. 28 Jul 64, 29p
RSIC 237; TT 64 71232

Unclassified report

Trans. of Schweizerische Bauzeitung, 1950, v. 68, no. 19, p. 253-257; no. 20, p. 265-267.

Descriptors: (*Photoelasticity, Laminates), (*Stresses, Photoelasticity), Moments, Deformation, Force (Mechanics), Polarization, Optical analysis, Measurement, Switzerland.

A description and an application of the method are given. The main properties of the deformations and the stresses for a bent thin plate made of a homogeneous and isotropic material are reviewed. Plates made of two adherent layers of different materials enable optical measurement of the moments of flection and torsion. The method is applied to a square plate, resting on three points, and supporting a force applied at its center.

AD-604 332 Div. 25, 14
OTS Prices: HC $1.00/MF $0.50

Redstone Scientific Information Center, Redstone Arsenal, Ala.
TREATISE ON THE CHROMATIC POLARIZATION PRODUCED BY COMPRESSED GLASS, by M. G. Wertheim. 24 Jul 64, 7p
RSIC 231; TT 64 71235

Unclassified report

Trans. of [Academie des Sciences, Paris]. Comptes Rendus (France) [1850], v. 32, p. 289-292 (pub. by Gauthier-Villars et Cie., Paris).

Descriptors: (*Glass, Compressive properties), (*Polarization, Glass), Light, Optical phenomena.

AD-604 341 Div. 25, 4, 14, 20
OTS Prices: HC $2.00/MF $0.50

Aerospace Technology Div., Library of Congress, Washington, D. C.
RADIATION DAMAGE IN SOLIDS: COMPILATION OF ABSTRACTS.
Rept. no. 1.
18 Aug 64, 48p
ATD P64 50; TT 64 71236

Unclassified report

Surveys of Soviet-bloc Scientific and Technical Literature.

Descriptors: (*Semiconductors, Radiation damage), (*Crystals, Radiation damage), (*Radiation damage, Materials), (*Abstracting, Radiation damage), Silicon, Germanium, Cadmium compounds, Sulfides, Selenides, Indium alloys, Antimony alloys, Gallium alloys, Arsenic alloys, Magnesium compounds, Zinc compounds, Titanates, Alkali metal compounds, Halides, Potassium compounds, Nitrates, Phosphate glass, Quartz, Polymers, Salts, Dielectrics, USSR.

Abstracts on radiation damage in semiconductors (silicon, germanium, cadmium sulfide, cadmium selenide, indium antimonide, and gallium arsenide); ionic crystals (alkali halides, magnesium and zinc titanates); and other materials (covalent, other crystalline, and amorphous substances).

AD-604 349 Div. 25, 8
OTS Prices: HC $3.00/MF $0.75

General Electric Co., Utica, N. Y.
FAILURE MECHANISMS AT SURFACES AND INTERFACES. Interim technical documentary rept. no. 3, 1 Jan-1 Apr 64, by K. K. Reinhartz, V. A. Russell, D. L. Stockman, W. J. van der Grinten, and W. L. Willis. Jul 64, 64p
Contract AF30 602 3085, Proj. 5519, Task 551906
RADC TDR64 197

Unclassified report

Descriptors: (*Semiconducting films, Surface properties), (*Semiconductor devices, Reliability (Electronics)), (*Failure (Mechanics), Semiconducting films), Films, Cadmium compounds, Sulfides, Silicon, Monoxides, Selenium compounds, Triodes, Transistors, Dielectrics, Stresses, Glass capacitors, Aging (Materials), Degradation, Surfaces, Controlled atmospheres, Electrical properties, Temperature, Oxides.

Certain fabrication details, relevant to the condition of the CdS-SiO interface, have been found to greatly influence the stress sensitivity of thin film field effect devices. This was found to be true for the aging effects resulting from high temperature exposures as well as from electrical stresses. Mechanism identification and suppression of these aging effects in terms of controlled processing techniques may be possible as a result of these findings. The unloaded room temperature stability has reached the 250 day landmark. An exploratory study of the incipient dielectric degradation of code 8871 glass capacitor dielectrics using thin film field effect sensors, has been initiated. Theoretical considerations concerning the migration of sodium and other ions in glass support the soundness of this approach. The mounting of such sensors on 8871 glass ribbon has been achieved and initial measurements are encouraging. (Author)

AD-604 355 Div. 25, 4
OTS Prices: HC $1.00/MF $0.50

Institute for the Study of Metals, Univ. of Chicago, Ill.
THE METASTABILITY OF AMORPHOUS STRUCTURES. Technical rept., by Morrel H. Cohen and David Turnbull. 7 Aug 64, 5p
Contract Nonr2121 22, Proj. NR017 632

Unclassified report

Prepared in cooperation with Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.

Descriptors: (*Glass, Stability), Molecular association, Transformations, Theory.

AD-604 380 Div. 25, 17
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A NOTE ON PLASTIC TORSION, by J. H. Huth. 28 Jun 54, rev. 26 Oct 54, 18p P-541

Unclassified report

Descriptors: (*Steel, Stresses), (*Shear stresses,

24. Photography and Other Reproduction Processes

AD-604 351 Div. 24, 25
OTS Prices: HC $2.00/MF $0.50

Naval Ordnance Lab., White Oak, Md.
A STUDY OF SLIT DETECTION BY RADIOGRAPHY, by E. L. Criscuolo and D. P. Case. 10 Apr 64, 40p
Task RUME 4E000 006
NOL TR64 55 Unclassified report

Descriptors: (*Radiography, Images), Photographic contrast, Resolution, Test methods, X-ray photography, Penetration, Equations, Non-destructive testing.

Slit detection by radiography is dependent upon image contrast, dimensions of the slit and unsharpness. Experiments show that the contrast reduction factor for narrow slits is not a linear relation with unsharpness. Thus the equations based upon theory are valid for slit widths either several times smaller or larger than the unsharpness. For conditions where the unsharpness and slit width are of the same order of magnitude, an empirical formula must be used. (Author)

of this definition are discussed. An example of a first order magnetic phase transition is discussed (AF - AF spin flop), and characterized by three parameters: anistropy energy, and parallel and perpendicular susceptibilities. (Author)

AD-604 425 Div. 25
OTS Prices: HC $1.00/MF $0.50

Mithras, Inc., Cambridge, Mass.
MEASUREMENT OF THE SPIN-FLOPPING RELAXATION TIME IN CuCl2 (2H2O).
Scientific rept. no. 2,
by Charles S. Naiman and Thomas R. Lawrence.
Jan 64, 19p MC-62-49-R2
Contract AF19 628 2395, Proj. 5621, Task 562104
AFCRL 64 456

Unclassified report

Descriptors: (*Magnetic materials, Phase studies), (*Copper compounds, Chlorides), Magnetic properties, Magnetic fields, Antiferromagnetism, Measurement, Dynamics, Mathematical analysis, Anistropy, Energy, Frequency shift, Crystals, Relaxation time, Transition temperature.

The relaxation time associated with the spin-flopping transition in CuCl2. 2H2O has been measured by an r. f. susceptibility technique and found to be (0. 70 ±0. 15) x10 to the minus 7th power seconds at 2.4K. We believe this to be the first such measurement on an order-order transition. Our preliminary measurements also yield the temperature dependence of the critical field, H sub c, in good agreement with previous data. Some otherwise strange observations have been qualitatively explained by a temperature rise due to the dissipation of energy in the crystal through the resistive component of the critical field susceptibility. These effects become more pronounced with increasing power which is consistent with their being of thermal origin. (Author)

AD-604 431 Div. 25, 30
OTS Prices: HC $4.00/MF $0.75

Charged Particle Research Lab., Univ. of Illinois, Urbana.
THE STABILITY OF ELECTRIFIED LIQUID SURFACES,
by John Matthew Schneider. 5 Mar 64, 121p
CPRL-2-64
Grants NSF G19776, NSF GP2372
AFOSR 64 1474

Unclassified report

Descriptors: (*Liquid jets, Static electricity), (*Sprays, Static electricity), (*Static electricity, Liquids), Capillary tubes, Drops, Surface properties, Electrostatics, Stability, Fluid flow, Surface tension, Dielectrics, Thermodynamics, Oscillation, Mechanical waves, Facsimile recording systems, Printing, Ion engines, Particle beams.

The study pertains to the stability of electrified liquid surfaces. The emphasis is placed upon the stability conditions which apply to liquids sprayed from a small cylindrical capillary tube. For the case of low flow rates a particular value of applied electric potential exists, above which, the liquid surface is unstable due to electrostatic forces. Calculations of the value of the minimum spraying potential are made using a modification of a theory originated by Rayleigh. The values of the minimum spraying potential thus obtained are compared to values determined from calculations made by Zeleny. For the case of high flow rates the jet is unstable under the action of surface tension provided that the wavelength of any disturbance on the jet is greater than the circumference of the jet. If charge is present on the jet, the forces due to the charge promote stability if the wavelength of the disturbance is greater than 0.6 times the circumference of the jet. If the wavelength of the disturbance is less than 0.6 times the circumference of the jet, the effect of charge on the jet promotes instability. (Author)

AD-604 435 Div. 25, 8
OTS Prices: HC $1.00/MF $0.50

Central Radio Propagation Lab., National Bureau of Standards, Boulder, Colo.
ON RADIATION OF ELECTROMAGNETIC AND ELECTROACOUSTIC WAVES IN PLASMA.
Scientific rept. no. 29,
by James R. Wait. 8 Jun 64, 16p
Contract PR062 201, Proj. 4600, Task 460004
AFCRL 64 473

Unclassified report

Descriptors: (*Plasma medium, Electromagnetic waves), (*Wave transmission, Plasma medium), Antennas, Plasma sheath, Compressive properties, Linear systems, Electric fields, Magnetic fields, Antenna configurations, Partial differential equations, Hydrodynamics, Electric currents, Distribution, Magnetohydrodynamics, Acoustics.

Radiation from current distributions in a lossless compressible plasma media is considered. A linearized theory is used such that the isotropic electron plasma is regarded as a single fluid continuum. It is found that a considerable portion of the power is radiated as an electroacoustic type wave. Some specialized results of other investigators are recovered. (Author)

AD-604 443 Div. 25, 14
OTS Prices: HC $1.00/MF $0.50

Eastman Kodak Co., Rochester, N. Y.
LASER MATERIAL STUDY.
Semi-annual technical rept. for 1 Jan-30 Jun 64,
by Paul B. Mauer. 30 Jun 64, 12p
Contract Nonr3834 00

Unclassified report

This research is part of Project DEFENDER under the joint sponsorship of the Advanced Research Projects Agency, the Office of Naval Research and the Department of Defense.

Descriptors: (*Lasers, Materials), (*Glass, Lasers), Performance (Engineering), Dielectric films, Fluorescence, Power, Reflection, Rods, Energy, Borates, Silicates, Life expectancy.

A performance study has been made of two types of laser material, matched quite closely in all characteristics except their fluorescence lifetime. Data has been recorded to indicate conversion efficiency as a function of input power and the reflectivity of the output mirror. In addition, an estimate of beam divergence has been made by comparing images recorded on carbon paper or developed, unexposed, Polaroid print paper. Conclusions have been drawn from these data as to the role of fluorescence lifetime and its related quantum efficiency to the practical performance of a laser material. (Author)

AD-604 445 Div. 25
OTS Prices: HC $4.00/MF $1.00

Ohio State Univ., Columbus. Research Foundation.
EMISSION SPECTRUM OF NITRIC OXIDE IN THE NEAR INFRARED.
Scientific rept. no. 2,
by Eugene Franklin Horn. May 64, 139p
Contract AF19 604 6150, Proj. 7670, Task 767002
AFCRL 64 583

Unclassified report

Descriptors: (*Nitrogen compounds, Oxides), (*Molecular spectroscopy, Nitrogen compounds), Vibration, Rotation, Calibration, Electromagnetic waves, Equations, Theory, Experimental data, Quantum statistics, Mathematical analysis, Infrared spectroscopy, Nuclear spins, Atomic energy levels.

Numerical analysis), Chromium alloys, Nickel alloys, Rods, Strain (Mechanics), Hardening, Deformation, Creep, Plasticity, Elasticity, Moments, Theory, Iterative methods.

The note presents numerical treatments of the torsion of a square rod for a material exhibiting strain hardening. Conclusions are drawn concerning the feasibility of the methods and a comparison is made between the deformation and flow theories. The latter theory is restricted to the special case of Laning's stress-strain relation. (Author)

AD-604 407 Div. 25, 1, 9, 12
OTS Prices: HC $5.00/MF $1.00

Norair Div., Northrop Corp., Hawthorne, Calif.
SIMULTANEOUS APPLICATION OF STATIC AND DYNAMIC LOADS ON SONIC FATIGUE TEST ARTICLES.
Rept. for Jun 62-Jun 63,
by W. H. Roberts and D. P. Wilhem. Jun 64, 151p
NOR-63-196
Contract AF33 657 8759, Proj. 4437, Task 443703
RTD TDR63 4021

Unclassified report

Descriptors: (*Loading (Mechanics), Sonic fatigue), (*Sonic fatigue, Tests), Simulation, Acoustics, Thermal stresses, Shock waves, Failure (Mechanics), Aircraft, Spacecraft, Guided missiles, Damage, Fluid flow, Stresses, Equations.

With the existence of the RTD sonic test facility, it becomes necessary to investigate the requirements for reliability fatigue testing during the simulated application of static, dynamic, and acoustic service loadings. The report includes the findings of an extensive investigation of previous combined load failures, documents the existence of such failures and suggests possible future problems based on an industry-wide survey of actual case histories. Analytical substantiation of the increased probability of failure and theoretical acoustic considerations are presented to indicate that combined loads do present a particular problem area. The simulation of static, dynamic, and acoustic loads is discussed in terms of general principles which must be taken into consideration, and general testing methods applicable to difficult and costly vehicle fatigue problems. Limitations and possible future extensions to the RTD sonic test facility are discussed and recommendations presented. Seven specific testing arrangements which have been developed for combined loads simulation of several selected cases are described and illustrated. (Author)

AD-604 409 Div. 25, 17
OTS Prices: HC $2.00/MF $0.50

Missouri School of Mines and Metallurgy, Rolla.
SOLUBILITY OF H IN Zr AT ROOM TEMPERATURE AND PROPERTIES OF THE SOLID SOLUTIONS.
Technical rept. no. 9,
by J. E. Straumanis and D. H. Wiebe. Aug 64, 33p
Contract Nonr2296 03

Unclassified report

Descriptors: (*Zirconium, Impurities), (*Hydrogen, Solid solutions), (*Solid solutions, Zirconium), Physical properties, Solubility, X-ray diffraction analysis, Crystal structure, Tensile properties, Ductility, Density, Crystal lattices, Wire, Phase studies, Thermal expansion, Toughness, Creep, Fatigue (Mechanics).

An investigation was made to find this maximum solubility limit of H in alpha-Zr at room temperature and to explore some physical properties of these solid solutions. The study involved the determination of: (1) The precise lattice parameters of alpha-Zr at room temperature, charged with different amounts of hydrogen, (2) The coefficients of thermal expansion of hydrogen containing alpha-Zr, (3) The densities of different Zr-H samples in the solid solution range, (4) The tensile properties of Zr (at room temperature) containing various amounts of hydrogen, and (5) The soundness or perfection of the structure of the alpha-Zr-H/solid solutions.

AD-604 417 Div. 25, 2, 5
OTS Prices: HC $3.00/MF $0.75

Alberta Univ., Edmonton.
SOME SPECTRAL COMPUTATION EXPERIMENTS.
Technical rept.,
by K. Vozoff and R. M. Ellis. 1963, 66p
Contract Nonr4072 00, Proj. NR371 550

Unclassified report

Descriptors: (*Radiofrequency spectroscopy, Mathematical analysis), Radio signals, Atmospherics, Radiofrequency interference, Electrical impedance, Recording systems, Spectrum analyzers, Canada.

The relative accuracy of computed power spectra was studied by examining spectral ratios from related signals. Attempts were made to improve the ratios by removing linear trends and by prewhitening the input signals. Two different spectral windows, Hanning and Daniell were compared. The effect of small relative time shifts between signals was also examined. The relation of these same factors to computed coherency was also studied. It was found that prewhitening always smoothed the ratios, extended the frequency range over which they were useful, and enhanced coherency. Trend removal sometimes leads to a deterioration in these factors. Spectral ratio and coherency were found to be very sensitive to small relative time shifts between signals, leading to the conclusion that simultaneous conversion is desirable if cross-spectral analysis is to be carried out. (Author)

AD-604 424 Div. 25
OTS Prices: HC $2.00/MF $0.50

Mithras, Inc., Cambridge, Mass.
TABULATION OF FIRST ORDER MAGNETIC PHASE TRANSITIONS.
Scientific rept. no. 3,
by Charles S. Naiman and Robert Gilmore. Oct 63, 26p
MC-62-49-R3
Contract AF19 628 2395, Proj. 5621, Task 562104
AFCRL 64 464

Unclassified report

Descriptors: (*Magnetic materials, Phase studies), Magnetic properties, Anistropy, Thermodynamics, Magnetic fields, Energy, Magnetism, Antiferromagnetism, Tables, Mathematical analysis, Relaxation time, Copper compounds, Chlorides, Transition temperature, Materials.

A literature search has been carried out and a tabulation has been made of all known first order magnetic phase transitions. The table includes all substances which have been found to undergo such phase transitions, and their relevant characteristics have been studied. The search has been conducted up to July 1963. One kind of transition (the so-called 'spin-flopping' type) exists for a very large class of materials. Since it can be characterized analytically in terms of other parameters of these materials, it was felt preferable to give a discussion of this transition, rather than an exhaustive literatue search. In order to properly guide the nature of the search, a definition of first order magnetic phase transitions is formulated in terms of familiar thermodynamic quantities. Sone of the implications

The purpose of the research was to study the crystal structure of sodium hyponitrite and potassium nitrite by the X-ray diffraction method. Three forms of sodium hyponitrite, i.e., anhydrous, octa, and pentahydrate, were obtained. Rotation and zero-level Weissenberg photographs were obtained and analyzed. Patterson projection, Patterson function, Harker section, and electron density contour maps were calculated. The crystal structure of potassium nitrite was redetermined. The cell dimensions were refined by improving the experimental techniques and employing the method of the least squares to minimize error. Instead of a monoclinic unit cell as reported, a rhombohedral cell seems most probable for the KNO2 crystal. The molecule is planar. A phase transformation was found at -17.7C. The thermal properties near the transition were measured.

AD-604 481 Div. 25, 9
OTS Prices: HC $2.00/MF $0.50

Brown Univ., Providence, R. I. Div. of Applied Mathematics.
ON THE PROPAGATION OF FORCED SOUNDWAVES IN RAREFIED GASDYNAMICS.
Technical rept. no. 59,
by Lawrence Sirovich and James K. Thurber. Aug 64, 40p
Contracts Nonr562 07, Nonr5360 01, Proj. NR062 179
Unclassified report

Prepared in cooperation with Adelphi Univ.

Descriptors: (*Sound, Propagation), (*Kinetic theory, Sound), (*Superaerodynamics, Acoustics), Oscillations, Pistons, Gases, Differential equations, Functions, Transformations (Mathematics).

A kinetic theory description of sound propagation in a simple gas is presented. The results are in very close agreement with experiment through all values of Knudsen number. (Author)

AD-604 482 Div. 25, 9
OTS Prices: HC $2.00/MF $0.50

Brown Univ., Providence, R. I. Div. of Applied Mathematics.
ON THE PROPAGATION OF FREE SOUNDWAVES IN RAREFIED GASDYNAMICS.
Technical rept. no. 58,
by Lawrence Sirovich and James K. Thurber. Jul 64, 50p
Contract Nonr562 07, Proj. NR062 179
Unclassified report

Descriptors: (*Sound, Propagation), (*Superaerodynamics, Acoustics), Oscillation, Gas flow, Functions, Differential equations, Polynomials, Integrals, Transformations (Mathematics), Kinetic theory.

A theory of sound propagation, employing general kinetic models, in an unbounded medium is presented. Numerical results for rigid sphere and Maxwell gas models are obtained. These are compared with already existing theories. (Author)

AD-604 489 Div. 25, 8
OTS Prices: HC $4.00/MF $0.75

Sylvania Electric Products, Inc., Mountain View, Calif.
INVESTIGATION OF NEW CONCEPTS FOR OPTICAL MIXING,
Final rept.,
by B. J. McMurtry, M. K. Oshman, A. E. Siegman, and W. B. Tiffany. 10 Oct 63, 112p
Contract AF19 628 2472, Proj. 4645
AFCRL 63 508
Unclassified report

Descriptors: (*Optical equipment, Photoelectric effect), (*Phototubes, Optical phenomena), (*Semiconductors, Photoelectric effect), Mixers (Electronic), Photoelectric materials, Crystals, Dielectrics, Emissivity, Traveling-wave tubes, Light, Signals, Detectors, Demodulation, Microwave equipment, Field theory, Very high frequency.

The report covers a research program conducted to investigate theoretically new concepts for mixing optical signals to determine which methods warrant experimental development. Particular emphasis is placed on exploring techniques that would be: (1) useful for very high difference frequencies (i.e., above 50 Gc); and (2) efficient mixers of weak optical signals. The major topics in the report are: (1) a discussion of generalized figures-of-merit for photodevices; (2) description and analysis of optical mixers using photoelectric emission; (3) description and analysis of optical mixing in semiconductors; and (4) a discussion of mixing in insulating crystals. The most extensive new analysis presented concerns distributed-emission phototubes and mixing in semiconductors. (Author)

AD-604 503 Div. 25
OTS Prices: HC $1.00/MF $0.50

Instrumentation Lab., Mass. Inst. of Tech., Cambridge.
GIMBAL AXIAL VIBRATION NONLINEARITIES,
by W. S. Crocker and T. E. Reed. Apr 61, 16p
E-1019
Contract AF04 647 303, Proj. 52 156
Unclassified report

Descriptors: (*Gimbals, Vibration), (*Vibration, Gimbals), Guided missiles, Mathematics, Theory, Damping, Reflection, Gyro stabilizers.

The report describes the investigation of the effects of various amplitudes of vibration on gimbal structures. Considerable study is required to ascertain a complete picture of the results of input acceleration on these structures. Studies conducted on the shaker with the use of a special, single-axis fixture to simulate the gimbals are described. (Author)

AD-604 520 Div. 25
OTS Prices: HC $1.00/MF $0.50

Purdue Univ., Lafayette, Ind. School of Aeronautical and Engineering Sciences.
MECHANICS OF MICROMORPHIC MATERIALS.
Technical rept. no. 26,
by A. Cemal Eringen. Apr 64, 24p
Contract Nonr1100 23
Unclassified report

Submitted for presentation at the International Congress of Applied Mechanics (11th), Munich, Germany, 30 Aug-5 Sep 64.

Descriptors: (*Continuum mechanics, Microstructure), (*Microstructure, Continuum mechanics), Stresses, Moments, Motion, Field theory, Liquids, Viscoelasticity, Theory.

The terminology 'micromorphic materials' is used to denote materials whose continuum behavior is dependent on the micro-structure of the material. The basic ideas and some recent results of a properly invariant continuum

The nitric oxide emission spectrum of the vibration-rotation bands of the electronic ground state has been observed in the 1.83-195 micron and 2.63-2.81 micron regions. A high tension discharge through NO at reduced pressure was utilized as the source. The 2.69, 2.73, and 2.77 micron bands were analyzed in detail and accurate values of the vibrational and rotational constants and the spin-orbit coupling constant A are presented. A calibration procedure utilizing atomic spectral lines was developed for use with the high-resolution grating spectrometer employed in the study. A detailed analysis of the applicability of the procedure is presented. (Author)

AD-604 447 Div. 25, 2
OTS Prices: HC $3.00/MF $0.75

California Research Corp., La Habra.
THE REFRACTED ARRIVAL FROM A LAYER.
Scientific rept. no. 6,
by T. W. Spencer. 15 Jun 64, 76p
Contract AF19 604 8344, Proj. 8652, ARPA Order 180 61, Task 865205
AFCRL 64 608

Unclassified report

Rept. on Proj. VELA-UNIFORM.

Descriptors: (*Wave transmission, Refraction), (*Refraction, Wave transmission), Reflection, High frequency, Theory, Degradation, Integral transforms, Surface properties, Interference, Velocity, Propagation, Equations, Thickness.

High-frequency geometric ray theory is used to study the refracted arrival from a layer embedded in an infinite medium. At large ranges, the amplitude decays less rapidly than for an infinitely thick layer. When the ratio of layer thickness to dominant wavelength is large, the refracted arrival may consist of more than one event and each event exhibits distance-limited shingling.

AD-604 448 Div. 25, 4
OTS Prices: HC $3.00/MF $0.75

Physical Studies, Inc., Kettering, Ohio.
INELASTIC, DISSOCIATIVE AND CHARGE EXCHANGE SCATTERING OF PROTONS BY NITROGEN.
Final rept.,
by R. G. Breene, Jr. 10 May 64, 89p
Contract AF19 628 2925, Projs. 7674, A8a
AFCRL 64 338

Unclassified report

Descriptors: (*Nitrogen, Proton scattering), (*Proton scattering, Nitrogen), (*Atomic energy levels, Nitrogen), Inelastic scattering, Dissociation, Exchange reactions, Field theory, Atomic orbitals, Molecular spectroscopy, Electron transitions, Excitation, Quantum mechanics.

Various channels for the collision of protons with nitrogen atoms are considered via the impact parameter treatment. In all cases the energy of the incident proton ranges from one to fifty KeV. The cross sections are first computed for three channels for the population of the upper state of the First Positive System through: (1) The transition to the mixed in singlet portion of the B state, (2) The spin flip transition to the B state and (3) The spin flip transition to the B' state and subsequent radiative transition to the B state. Next the cross section for the collisional dissociation into two doublet D nitrogen atoms is calculated. The effect of certain approximations are outlined analytically. The charge transfer collision channel is set up although the cross sections have not yet been calculated. Finally a method of including the effects of molecular rotation is detailed. (Author)

AD-604 467 Div. 25, 15
OTS Prices: HC $1.00/MF $0.50

Polytechnic Inst. of Brooklyn, N. Y.
A FURTHER NOTE ON THE CREEP ANALYSIS OF ANNULAR PLATES,
by B. Venkatraman, Sharad A. Patel, and Michael R. Birnbaum. May 64, 13p PIBAL-695
Contract AF49 638 1360, Proj. 9782, Task 978201
AFOSR 64 1039

Unclassified report

Descriptors: (*Flat plate models, Creep), (*Creep, Mathematical analysis), Rings, Stresses, Load distribution, Moments, Deformation, Equations, Numerical methods and procedures.

On the basis of a creep law formulated in terms of the Tresca criterion, the creep bending of annular plates were analysed by Venkatraman and Patel. The present note considers the solutions presented there for plates with sufficiently small holes and sufficiently large holes and quantitatively defines the transition from one solution to the other. The note concludes with the complete solution to the problem of an annular plate with its inner edge free and outer edge clamped and under uniform lateral pressure. (Author)

AD-604 468 Div. 25
OTS Prices: HC $1.00/MF $0.50

Pennsylvania State Univ., University Park.
PHYSICAL PROPERTIES OF ISOTOPICALLY SUBSTITUTED FLUIDS,
by William A. Steele. 21 Jan 64, 9p
Grant AF AFOSR61 27
AFOSR 64 1417

Unclassified report

Descriptors: (*Deuterated compounds, Physical properties), (*Balances, Design), Laboratory equipment, Construction, Gases, Purification, Labeled substances, Liquids, Vapor pressure, Density.

The work consisted essentially in the design and construction of a low temperature, high pressure density balance and the associated equipment for the precise measurement and control of temperature and pressure. Some work was also done on the problem of purification of the gases to be used in the balance. A balance was constructed which appears to have the desired performance. The report is primarily concerned with a description of this apparatus and the problems met in its design and construction. (Author)

AD-604 476 Div. 25
OTS Prices: HC $4.00/MF $0.75

Kansas State Univ., Manhattan.
THE CRYSTALLOGRAPHY OF SOLID NITROGEN OXIDES: SODIUM HYPONITRITE, POTASSIUM NITRITE.
Final rept.,
by R. Dean Dragsdorf, Shih Chi Chang, and Ralph L. Hollis. 3 Aug 64, 103p
Grant AF AFOSR61 24
AFOSR 64 1469

Unclassified report

Descriptors: (*Sodium compounds, Nitrites), (*Potassium compounds, Nitrites), (*Nitrites, Crystal structure), Nitrogen compounds, Oxides, Crystallography, Crystal substructure, Crystal lattices, X-ray diffraction analysis, Chemical bonds, Molecular structure, Phase studies, Thermal properties.

AD-604 652 Div. 25, 15
OTS Prices: HC $2.00/MF $0.50

Frick Chemical Lab., Princeton Univ., N. J.
GENERAL FOURIER AND SUPERPOSITION FOURIER PROGRAMS (CDC 1604).
Technical rept. no. 3,
by Robert A. Jacobson. Aug 64, 42p
Grants DA ARO D31 124G265; NSF GP79, Proj. 3083C
AROD 3083 14

Unclassified report

Descriptors: (*Crystal lattices, Mapping (Transformations)), (*Fourier analysis, Series), Crystallography, Crystal substructure, X-ray diffraction analysis, Integral transforms, Programming (Computers), Computers.

The Fourier program is designed to compute electron density, or Patterson maps, or other similar Fourier functions using relatively small amounts of computing time. Maps can be computed in intervals of 240ths of the unit cell or larger, and the output is in two-character coded format, modular 1024. The superposition Fourier program is designed to superimpose Patterson Maps using BC tape images in a buffered fashion and output the resultant map in coded and BC formats. The average computation time is 3-5 minutes. (Author)

AD-604 659 Div. 25
OTS Prices: HC $5.00/MF $1.00

Microwave Lab., Stanford Univ., Calif.
ON SHARP OPTICAL TRANSITIONS IN CRYSTALS; EFFECTS OF STATIC AND DYNAMIC PERTURBATIONS.
Interim technical rept.
by G. F. imbusch. Jul 64, 185p ML-1190
Contract DA31 124ARO D208
AROD 3780:1

Unclassified report

Descriptors: (*Crystals, Optical properties), (*Magnesium compounds, Oxides), (*Chromium, Line spectrum), (*Vanadium, Line spectrum), Crystal lattices, Impurities, Atomic properties, Phonons, Ions, Magnetic fields, Electric fields, Pressure, Isotopes, Dipole moments, Lasers, Optical materials.

The investigation was concerned with the effects of some perturbations on the sharp optical lines emitted by chromium and vanadium ions in MgO. Because the atomic states of the impurity ion are dependent on the lattice environment, it is possible to modify the radiation from such impurity ions by perturbing the host crystal. The following effects were investigated: (i) the effect of the perturbations caused by lattice vibrations (phonons) on the radiation, and (ii), the effects of static perturbations (pressure, magnetic fields and electric fields) on the optical transitions.

AD-604 660 Div. 25, 8
OTS Prices: HC $5.00/MF $1.00

Shockley Transistor Div., Clevite Transistor, Palo Alto, Calif.
RESEARCH ON THE INFLUENCE OF SURFACE CONDITIONS ON DIFFUSION IN SILICON.
Final rept. for 16 Jun 61-15 Jun 64,
ed. by Reinhard K. Gereth. Jul 64, 181p
Contract DA04 2000RD1166X, Proj. 59901007
AROD 3330:4

Unclassified report

Descriptors: (*Silicon, Diffusion), (*Semiconductors, Impurities), Ion bombardment, Crystal lattice defects, Phosphorus, Boron, Oxides, Aluminum, Equations, Integrals, Deformation, Electron microscopy, Surface properties, Glow discharges.

The purpose of the contract was to study the diffusion of impurities, particularly donors and acceptors, near the surface of silicon as affected by disturbances introduced at the surface before or during diffusion. This goal was achieved by carrying out three major research projects concerned with: (1) Ion bombardment and simultaneous doping of silicon in a dc glow discharge. (2) Studies of anomalous diffusion in heavily doped surface layers. (3) Observation of lattice defects such as misfit dislocations near silicon surfaces doped with phosphorus and defects related to surface damage. The results of the investigations are presented in this report.

AD-604 661 Div. 25
OTS Prices: HC $1.00/MF $0.50

Brown Univ., Providence, R. I. Div. of Applied Mathematics.
WAVE PROPAGATION IN THE LINEAR THEORY OF VISCOELASTICITY.
Technical rept. no. 28,
by George M. C. Fisher and Morton E. Gurtin. Aug 64, 16p
Contract Nonr562 25, Proj. NR064 431

Unclassified report

Descriptors: (*Viscoelasticity, Theory), (*Mechanical waves, Propagation), Shock waves, Acceleration, Relaxation time, Density, Linear systems, Vector analysis.

It was shown in AD-436 823 that, in the linear theory of viscoelasticity, the speed of propagation of an acceleration wave is a solution of a particular eigenvalue problem. It is demonstrated that this eigenvalue problem governs, not only the speed of propagation of acceleration waves, but also the propagation speeds of shocks and all higher order waves. Solutions which contain discontinuities of arbitrary order N are easily exhibited.

AD-604 664 Div. 25
OTS Prices: HC $1.00/MF $0.50

Washington Univ., St. Louis, Mo.
IONIC PROPERTIES AND MOTIONS IN GASES AND LIQUIDS.
Terminal rept.,
by Robert N. Varney. 30 Jun 64, 5p
Grants DA ARO D31 124G454, DA ARO D31 124G532
Projs. 20010501B700, 2802p
AROD 2802 8

Unclassified report

Descriptors: (*Plasma medium, Ions), (*Ions, Physical properties), Motion, Gases, Vapors, Liquids, Liquefied gases, Mercury, Argon, Nitrogen, Hydrogen, Secondary emission, Mass spectroscopy, Reviews.

Research was undertaken and completed on the following topics: formation of and secondary emission by Hg metastables; velocities of ions in liquefied gases (Ar and N2); mobilities of ions in hydrogen; mass spectrographic studies of H3+ and H5+ ions; reactions of nitrogen ions and molecules; velocities of ions in nitrogen; mobilities of Hg ions in Hg vapor. Partially completed are: velocities of ions in liquid He; combined mass spectrograph and mobility shutter tube. (Author)

theory applicable to such materials are presented. The theory gives rise to some new concepts pertaining to stress moments, inertial spin and microgyrations whereby the laws of motion require adjoining certain additional principles to the basic axioms of mechanics. The basic principles are systematically introduced and discussed. Field equations, jump conditions and constitutive equations for simple microfluids are presented in some detail as an example of the general theory. It is shown how some of thep previously developed theories of anisotropic fluids turn out to be special cases of the present theory. A theory of linear microviscoelasticity is given. (Author)

AD-604 535 Div. 25
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ON WAVES OF LOADING AND UNLOADING, ARISING FROM THE MOTION OF AN ELASTIC OR PLASTIC FLEXIBLE FIBRE,
by N. Cristescu. 23 Aug 55, 22p T-49
TT 64 71240

Unclassified report

Trans. of Prikladnaya Matematika i Mekhanika (USSR) 1954, v. 18, no. 3, p. 257-264.

Descriptors: (*Fibers, Mechanical waves), (*Cables, Mechanical waves), Loading (Mechanics), Elasticity, Plasticity, Strain (Mechanics), Motion, Linear systems, Numerical analysis, USSR, Rumania.

The work consists of three sections. In the first section, with the aid of the method of characteristics, consideration is given to transverse and longitudinal waves propagating in a flexible (elastic or plastic) fibre. The tension is presupposed as a given function of strain. In the second section, the motion of a semi-infinite fibre is considered. The force of the reaction at the end of the fibre is such, that the material of that part exceeds the limit of elasticity. Waves of loading and unloading are investigated with the hypothesis of ideal plasticity. The third section is devoted to the same problem in the case of a linear approximation. (Author)

AD-604 601 Div. 25
OTS Prices: HC $2.00/MF $0.50

Rochester Univ., N. Y.
THEORETICAL STUDIES OF THE ELECTROMAGNETIC FIELD IN THE FOCAL REGION OF COHERENT LIGHT BEAMS.
Final rept. for 1 Aug 62-31 Jul 64,
by Emil Wolf. Aug 64, 33p
Grant DA ARO D31 124G325, Proj. 3663P
AROD 3663 14

Unclassified report

Descriptors: (*Lasers, Electromagnetic fields), (*Electromagnetic fields, Lasers), Light, Oscillation, Detection, Photoelectric effect, Quantum mechanics, Bibliographies, Reviews.

A study was made of the structure of the electromagnetic field in the neighborhood of the focus of a coherent beam. Some related studies were also undertaken, concerned chiefly with coherence properties of light, photoelectric detection of light fluctuations and the relation between the semi-classical and quantum mechanical description of light beams. Results of these investigations are contained in 11 published papers. Titles, authors and journal references are listed. Summaries, which record the main results obtained are given. (Author)

AD-604 602 Div. 25
OTS Prices: HC $1.00/MF $0.50

Redstone Scientific Information Center, Redstone Arsenal, Ala.
RECENT DEVELOPMENTS IN PHOTOELASTICITY,
by A. Pirard. 10 Aug 64, 22p
RSIC 240; TT 64 71248

Unclassified report

Trans. of la Métallurgie [et la Construction Mécanique] (France) 1947, v. 79, p. 17-21.

Descriptors: (*Photoelasticity, Reviews), Mechanical properties, Optical properties, Test methods, Laboratory equipment, Optical equipment, France, Belgium.

A summary outline is presented of the procedures used in the Photoelasticity Laboratory of the University of Liege.

AD-604 603 Div. 25
OTS Prices: HC $1.00/MF $0.50

Redstone Scientific Information Center, Redstone Arsenal, Ala.
THE MEASUREMENT OF PHOTOELASTICITY,
by A. Barat. 10 Aug 64, 24p
RSIC 244; TT 64 71249

Unclassified report

Trans. of Revue Generale de Mecanique (France) 1947, v. 31, p. 333-339, 341.

Descriptors: (*Photoelasticity, Measurement), Mechanical properties, Optical properties, Test methods, Laboratory equipment, Optical equipment, Materials, Reviews, France.

AD-604 631 Div. 25
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ON THE USE OF THE GENERAL BENDING FORMULA,
by W. P. Rodden. 18 Jan 55, 4p P-626

Unclassified report

Descriptors: (*Loading (Mechanics), Equations), Stresses, Deflection, Integrals, Digital computers.

AD-604 642 Div. 25
OTS Prices: HC $3.00/MF $0.75

RAND Corp., Santa Monica, Calif.
CREEP BUCKLING: AN ENGINEERING SURVEY,
by F. R. Shanley. Jun 54, P-641

Unclassified report

Descriptors: (*Creep, Theory), (*Buckling (Mechanics), Theory), Elasticity, Loading (Mechanics), Strain (Mechanics), Stresses, Deflection, Equations, Tensile properties, Compressive properties.

The present status of creep-buckling theory is reviewed in the light of the development of column theory, including the elastic theory for straight columns (Euler), inelastic column theory (Engesser-Karman-Shanley), and eccentric columns (Karman, etc.). It is shown that the existence of a critical time requires a nonlinear (increasing) relationship between the creep strain rate and the stress. The isotangent-modulus method is described and applied to various types of buckling and design problems. Mathematical theories of creep-buckling are discussed in a general way. Suggestions for future analytical and experimental work on this phenomenon are included. (Author)

ber of solutions available in the past. A number of solutions sufficiently extensive to determine the thermodynamic properties of all elements over an exceedingly wide range of temperatures and densities were obtained with the aid of an IBM 701 Defense Calculator. The results are presented in graphical form. In addition, some of the analytic properties of the Thomas-Fermi equations were investigated and certain approximate analytic solutions have been derived for limiting cases. (Author)

AD-604 706 Div. 25
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
LINE BROADENING BY ELECTRONS: THE VALIDITY OF SIMPLE THEORIES,
by Roland E. Meyerott. 9 May 55, 12p P-672
Unclassified report

Prepared in cooperation with Yale Univ., New Haven, Conn.

Descriptors: (*Line spectrum, Distortion), (*Electrons, Line spectrum), Spectroscopy, Theory, Quantum mechanics.

A comparison is made between simple impact theories of line broadening by electrons (Weisskops, Lindholm, Inglis and Teller, Unsold) and recent more detailed quantum calculations by Kivel, Bloom and Margenau. (Author)

AD-604 728 Div. 25, 6, 8
OTS Prices: HC $1.00/MF $0.50

Quantum Electronics Lab., Calif. Inst. of Tech., Pasadena.
LASER ELECTROMAGNETICS.
Final rept.
by Nicholas George. 1 Jul 64, 16p
Contract AF19 604 8052, Proj. 4600, Task 460006
AFCRL 64 538
Unclassified report

Descriptors: (*Lasers, Electromagnetic properties), (*Electromagnetism, Lasers), Oscillators, Propagation, Detection, Very high frequency, Electromagnetic waves.

This program of research is in the field of LASER ELECTROMAGNETICS, and it includes research into the generation, propagation, and detection of very high frequency (optical) coherent electromagnetic radiation. Solutions to several specific problems of research importance in this field have been obtained and were reported separately. Abstracts of the following reports are included in this report: Light Scattering from Dielectric Film Laser Mirrors (AD-298 726), Modified Fabry-Perot Interferometer (AD-296 948), Multireflector Optical Resonators (AD-406 323), Interferometric Measurement of Index of Refraction, and Plasma Diagnosis by Means of Photon-Electron Scattering (AD-437 790). (Author)

AD-604 735 Div. 25, 8
OTS Prices: HC $3.00/MF $0.75

Bege (J.R.M.) Co., Arlington, Mass.
LASER BEAM ATTENUATION IN THE LOWER ATMOSPHERE,
by R. M. Langer. 22 Nov 63, 86p Bege-6331
Contract NObs88609 Unclassified report

Descriptors: (*Lasers, Electromagnetic waves), (*Electromagnetic waves, Attenuation), (*Atmosphere, Light transmission), Wave transmission, Clouds, Refractive index, Aerosols, Scattering, Absorption, Optics.

Small angle spreading, aerosol scattering and molecular absorption are considered the important mechanisms for the weakening of a laser beam in the open atmosphere. Three different transmission laws are worked out for these three mechanisms. Both the physical principles and the numerical values encountered in the lower atmosphere are discussed and illustrated. Random density fluctuations in the turbulent atmosphere are discussed as the cause of small angular deflections in a narrow pencil of light. Beam attenuation due to atmospheric aerosol scattering is treated for an aerosol size distribution described by the sum of two inverse powers of the droplet radius. Laser beams can help find the parameters of such distributions. Molecular absorption is examined in terms of the narrow infrared lines of water vapour. An effort is made to present this difficult topic in as simple and useful a form as is compatible with the observational material. The formulae are designed to make it possible to estimate in detail how the atmosphere would weaken a laser beam under a wide variety of conditions. It is found that some effects are serious even at short ranges of a few meters, while in favourable circumstances, laser signals would not be drastically attenuated out to any practical distance in the lower atmosphere. (Author)

AD-604 742 Div. 25, 8
OTS Prices: HC $1.00/MF $0.50

Westinghouse Electric Corp., Elmira, N. Y.
APPLICATION OF LIGHT AND IMAGE INTENSIFICATION.
Monthly technical engineering rept. no. 7, 1-31 Jan 64,
by Z. Szepesi, W. A. Thornton, and R. E. W. Lake.
25 Feb 64, 7p
Contract N61339 1440
Unclassified report

See also AD-603 526.

Descriptors: (*Image intensifiers(Electronic), Preparation), (*Photoelectric materials, Image intensifiers (Electronic)), (*Luminescence, Image intensifiers (Electronic)), Plastics, Capacitance, Laminates, Photoconductivity, Powders, Photoelectric cells (Semiconductor), Cadmium compounds, Sulfides, Light, Intensity, Brightness, Films, Zinc compounds, Electrical insulation, Silicon compounds, Monoxides, Magnesium compounds, Fluorides.

The effect of different plastic materials on the characteristics, and chiefly on the capacitance of PC layers was studied. The effect of the substrate material was investigated also. Several batches of PC powders were prepared and some image intensifier panels were fabricated. A simple lightmeter, using a linear (current vs. light intensity) CdS PC cell, for the easy measurement of light intensities and brightnesses, was constructed. In the evaporated EL film program the effect of an insulating film on either or both sides of the EL film was studied. (Author)

AD-604 743 Div. 25, 8
OTS Prices: HC $1.00/MF $0.50

Westinghouse Electric Corp., Elmira, N. Y.
APPLICATION OF LIGHT AND IMAGE INTENSIFICATION.
Monthly technical engineering rept. no. 9, 1-31 Mar 64,

AD-604 673 Div. 25
OTS Prices: HC $3.00/MF $0.75

RAND Corp., Santa Monica, Calif.
HEAT TRANSFER RESEARCH IN JAPAN,
by J. P. Hartnett. Apr 62, 64p P-2564
Unclassified report

Supported by the John Simon Guggenheim Memorial Foundation.

Descriptors: (*Heat transfer, Scientific research), Universities, Bibliographies, Laboratories, Industries, Scientific personnel, Japan.

AD-604 691 Div. 25
OTS Prices: HC $1.00/MF $0.50

Kansas State Univ., Manhattan.
SENSITIZED FLUORESCENCE.
Semiannual technical summary rept. no. 2, 1 Jan-30 Jun 63,
by Basil Curnutte, Jr. 30 Jun 63, 20p
Contract Nonr3634 02, Proj. 3730; ARPA Order 306 62
Unclassified report

Rept. on Proj. DEFENDER.

Descriptors: (*Mercury, Fluorescence), (*Fluorescence, Quenching (Inhibition)), (*Thallium, Quenching (Inhibition)), Optical phenomena, Mercury lamps, Quartz, Light, Energy, Laboratory furnaces, Equations, Temperature control, Experimental data, Sensitivity.

Progress in the measurement of the total quenching cross section of thallium on mercury fluorescence is described. Results of an experimental determination of the total quenching cross section are given and an analysis of the data is presented. Plans for the direction of experimental work for the next quarter are outlined. (Author)

AD-604 694 Div. 25
OTS Prices: HC $3.00/MF $0.75

RAND Corp., Santa Monica, Calif.
NUMERICAL SOLUTIONS OF THE THOMAS-FERMI STATISTICAL MODEL,
by R. Latter. 15 Apr 55, 62p P-656
Unclassified report

Descriptors: (*Atomic structure, Mathematical models), Atomic properties, Atomic energy levels, Numerical analysis, Statistical functions, Tables.

Solutions of the zero-temperature Thomas-Fermi equation for an atomic system were obtained by numerical integration with the aid of the IBM 701 Defense Calculator. The complete range of atomic volumes of physical interest was covered in sufficient detail to permit accurate interpolation to intermediate regions. Tables of the potential distributions are given as well as of the important physical properties. (Author)

AD-604 701 Div. 25, 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A GENERAL TRANSFORMATION FOR ORTHOTROPIC PLANE STRESS AND PLANE STRAIN PROBLEMS,
by H. A. Lang. Rev. 23 May 55, 18p P-664
Unclassified report

Descriptors: (*Stresses, Mathematical analysis), (*Strain (Mechanics), Mathematical analysis), (*Transformations (Mathematics), Mechanics), Numerical methods and procedures.

It is demonstrated that a single affine transformation of the type $x = ax'$, $y = by'$ immediately extends the solution of any isotropic plane stress or plane strain problem to the solution of an orthotropic plane problem where the orthotropic material is characterized by three independent constants. Since orthotropy, defined as elastic symmetry with respect to two orthogonal axes, implies four independent elastic constant, the affine transformation introduces a restriction upon the orthotropic shear modulus. The orthotropic shear modulus differs from that used by previous investigators. This difference alters the equation which the orthotropic stress function must satisfy and therefore, directly affects the solution to every plane stress or plane strain problem. Some arguments are advanced to favor the shear modulus, as here defined, whenever orthotropy must be restricted to three elastic constants. The two solutions of the orthotropic half plane subjected to a normal concentrated load are contrasted to illustrate the effect of the two definitions of orthotropic shear modulus. (Author)

AD-604 703 Div. 25
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A PROPOSED MECHANISM OF FATIGUE FAILURE,
by F. R. Shanley. 11 Apr 55, 20p P-666
Unclassified report

Descriptors: (*Fatigue (Mechanics), Theory), Failure (Mechanics), Strain (Mechanics), Shear stresses, Loading (Mechanics), Atoms, Crystal lattices, Tensile properties, Deformation, Equations, Chemical bonds.

Reversed slip is assumed to occur on a single plane, either from the beginning of repeated loading, or after an initial period of slip on different planes. Such slip requires unbonding of the atoms which emerge at the surface of the material. It is assumed that a portion of these atoms do not regain their original bond when the slip is reversed. This results in progressive unbonding along the slip plane. The proposed mechanism is shown to be in agreement with observed facts and is used as a basis for deriving various well-known equations for the sigma-N diagram. The mechanism and equations are used to interpret and explain such phenomena as the endurance limit, effects of mean stress, variable amplitude loading, stress-concentration, elevated temperature, corrosion, and surface treatment. (Author)

AD-604 704 Div. 25
OTS Prices: HC $3.00/MF $0.50

RAND Corp., Santa Monica, Calif.
TEMPERATURE BEHAVIOR OF THE THOMAS-FERMI STATISTICAL MODEL FOR ATOMS,
by Richard Latter. 25 Apr 55, 56p P-667
Unclassified report

Descriptors: (*Atomic structure, Mathematical models), (*Thermodynamics, Atomic structure), Atomic properties, Atomic energy levels, Temperature, Density, Specific heat, Equations of state, Statistical functions, Nonlinear differential equations, Numerical analysis.

The usual theoretical calculations of equations of state and specific heats, particularly at high temperatures and pressures, are dependent on the Thomas-Fermi statistical model of the atom. The mathematical description of this model involves complicated nonlinear differential equations, for which there have been an inadequate num-

ON THE SPIN AND THE STRUCTURE OF ELECTRONS.
by F. Bopp. Jan 51, 14p T-21
TT 64 71271

Unclassified report

Trans. of mono. paper presented at a meeting of the Physikalische Gesellschaft in Bayern, Munich, 22 Oct 48.

Descriptors: (*Electrons, Quantum mechanics), Nuclear spins, Dipole moments, Field theory, Atomic orbitals, Fine structure, West Germany.

AD-604 791 Div. 25, 2, 9, 12
OTS Prices: HC $3.00/MF $1.00

RAND Corp., Santa Monica, Calif.
THE THERMODYNAMIC PROPERTIES OF 85% CO2 AND 15% NITROGEN TO 24000K,
by Warren C. Strahle. Sep 61, 88p P-2456

Unclassified report

Descriptors: (*Planetary atmospheres, Venus), (*Venus probes, Atmosphere entry), (*Carbon dioxide, Thermodynamics), (*Nitrogen, Thermodynamics), Gases, Mixtures, Dissociation, Ionization, Entropy, Enthalpy, Heat of formation, Density.

The equilibrium thermodynamic properties of a volumetric mixture of 85% carbon dioxide and 15% nitrogen are presented over the temperature and pressure ranges of from 1000K to 24000K and 0.0001 to 100 atm, respectively. It is expected that the prime use of these properties will be in preliminary design studies for probes to enter the Venus atmosphere. (Author)

AD-604 827 Div. 25, 7
OTS Prices: HC $4.00/MF $0.75

Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
ION CLOUD SHAPE AND POTENTIAL DISTRIBUTION IN AN ELECTRO-FLUID-DYNAMIC GENERATOR.
Master's thesis,
by James Robert Wifall. Jun 64, 122p
AFIT GAM/ME/64-22

Unclassified report

Descriptors: (*Plasma medium, Physical properties), (*Energy conversion, Plasma physics), Ions, Voltage, Distribution, Probes (Electromagnetic), Electrical corona, Electrostatics, Electric fields, Turbulence, Diffusion, Generators, Spacecraft, Power supplies.

The purpose of the study was to experimentally determine the ion cloud shape and potential distribution within the conversion section of an electro-fluid-dynamic generator. Phase I of the study dealt with the investigation of a uniform electro-static field with and without a corona discharge. The results showed that an extremely sharp probe point is required to measure the potential of an electrostatic field and that the ion cloud, emanating from a single needle in a fluid with zero velocity, is parabolic in shape. In Phase II the conversion section was probed with a sharp pointed probe. Results showed that the flow pattern has a greater influence on the ion cloud shape than electrostatic forces, and therefore the ion cloud diverges rapidly due to the high turbulence. (Author)

AD-604 830 Div. 25
OTS Prices: HC $5.00/MF $1.00

Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
HEAT TRANSFER BY COMBINED CONDUCTION AND RADIATION THROUGH A RADIATING GAS.
Master's thesis,
by Carl Gene Stolberg. Jun 64, 152p
AFIT GAM/ME/64 20

Unclassified report

Descriptors: (*Heat transfer, Gases), Thermal conductivity, Thermal radiation, Flat plate models, Cylindrical bodies, Thermodynamics, Temperature sensitive elements, Energy, Digital computers, Statistical data.

Combined conduction and radiation through a radiating gas between flat plates and concentric cylinders, having gray-isothermal surfaces, is investigated. The energy equation for weakly absorbing gases and small differences between surface temperatures is solved analytically for flat plates and numerically for concentric cylinders. For concentric cylinders, 114 different digital computer solutions are given. The effects of radius ratio and surface emissivity are illustrated. Finally, an apparatus designed to verify the theoretical calculations, for temperatures less than 2000R and pressures less than 20 atm, is described. (Author)

AD-604 831 Div. 25
OTS Prices: HC $2.00/MF $0.50

Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
CONSTRUCTION, TEST, AND CALIBRATION OF A HIGH-TEMPERATURE DIPHENYL ETHER DROP-TYPE CALORIMETER.
Master's thesis,
by Thomas Marion McMillin. Jun 64, 48p
AFIT GAW/ME/64 1

Unclassified report

Descriptors: (*Calorimeters, Operation), Temperature sensitive elements, Construction, Tests, Calibration, Ethers, Capillary tubes, Furnaces, Platinum, Nickel, Thermodynamics, High-temperature research.

The Bunsen drop-type calorimeter, based on the heat required to melt a frozen substance, was first used about 1760 by Dr. Joseph Black. This type of calorimeter measures the expansion of the melting substance after a heated sample is dropped into the area of the frozen substance. A furnace designed for operation up to 1500C heats the sample, and diphenyl ether provides the working substance which forces mercury along a calibrated capillary tube. Testing has permitted calibration of the capillary and calculation of the amount of heat lost from a sample during its drop from the furnace to the calorimeter. The calculated calorimeter constant of 19.1 cal/g Hg displaced agrees reasonably with constants determined by other researchers. The results of initial testing of platinum and nickel show correlation with published data. Discussions of problems, and recommendations for further work give guidance for refinemen of the equipment. (Author)

AD-604 832 Div. 25, 21
OTS Prices: HC $4.00/MF $0.75

Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
GAS SEPARATION IN A VORTEX.
Master's thesis,
by Anthony J. Zappanti. May 64, 122p
AFIT GAW/ME/64 3

Unclassified report

Descriptors: (*Vortices, Separation), (*Carbon dioxide, Vortices), Gases, Injection, Hilsch tubes, Plasma medium, Stabilization, Space nuclear propulsion.

by D. C. Fowlis, R. D. Harder, R. E. W. Lake, Z. Szepesi, and W. A. Thornton. 13 Apr 64, 9p
Contract N61339 1440

Unclassified report

See also AD-604 745.

Descriptors: (*Image intensifiers (Electronic), Preparation), (*Photoelectric materials, Image intensifiers (Electronic)) (*Luminescence, Image intensifiers (Electronic)), Cadmium compounds, Selenides, Powders, Purification, Sublimination, Photoconductivity, Impurities, Zinc, Oxygen, Clorine, Iodine, Hall effect, Signal-to-noise ratio, Films, Zinc compounds, Sintering, Magnesium compounds, Oxides, Light, Amplifiers.

A small amount of CdSe powder was purified by a sublimation method. Chemical analysis of the purified powder is being made. Studying the effects of Zn impurities on the photoelectronic characteristics of CdSe sintered PC cells ended with the conclusion that Zn is an undesirable impurity. Work with ZnSe was started. No success was achieved yet in either sintering or sensitization of this powder. Hall effect measurements were made with imporved signal to noise ratio. In the PC powder program the effect of oxygen and of halogens (Cl and 1) was studied. More green emitting EL films were made, because they show about 10 times higher efficiency than yellow films. Characteristics of EL films and sintered CdSe PC elements and of their combination in light amplifier were measured and analyzed. (Author)

AD-604 744 Div. 25, 8
OTS Prices: HC $1.00/MF $0.50

Westinghouse Electric Corp., Elmira, N. Y.
APPLICATION OF LIGHT AND IMAGE INTENSIFICATION.
Monthly technical engineering rept. no. 10, 1-30 Apr 64, by D. C. Fowlis, R. D. Harder, R. E. W. Lake, Z. Szepesi, and W. A. Thornton. 13 May 64, 11p
Contract N61339 1440

Unclassified report

See also AD-604 743.

Descriptors: (*Image intensifiers (Electronic), Preparation), (*Photoelectric materials, Image intensifiers (Electronic)), (*Luminescence, Image intensifiers (Electronic)), Cadmium compounds, Selenides, Spectroscopy, Synthesis (Chemistry), Purification, Sublimation, Photoconductivity, Zinc compounds, Sintering, Impurities, Iodine, Films, Tin compounds, Oxides, Coatings, Deposits, Light, Amplifiers, Gain.

Spectral analysis of CdSe powders, purified by sublimation, shows some improvement, but probably purer material can be obtained by improving the condition under which the material is prepared and by more careful handling of the material. A small amount of CdSe was prepared by synthesizing it from very pure Cd and Se. The same comments apply for this method as for the sublimation. Experiments with ZnSe did not show good sintering. Oxide impurities in the powder are suspected and purification by the sublimation method is being prepared. Work was started in developing a better deposition method for the PC layer. Several series of experiments for the preparation of PC powders were made, but sensitivities obtained by the described method are still many orders of magnitude lower than required. Regarding EL films, improvements in tin oxide coating and in the preparation of larger size (6 in. x 6in) panels were made. Some small size image intensifiers were made by depositing highly sensitive PC powder on EL films. Gains around unity were measured. (Author)

AD-604 745 Div. 25, 8
OTS Prices: HC $1.00/MF $0.50

Westinghouse Electric Corp., Elmira, N. Y.
APPLICATION OF LIGHT AND IMAGE ITENSIFICATION.
Monthly technical engineering rept. no. 8, 1-29 Feb 64, by D. C. Fowlis, R. D. Harder, R. E. W. Lake, Z. Szepesi, and W. A. Thornton. 13 Mar 64, 8p
Contract N61339 1440

Unclassified report

See also AD-604 742.

Descriptors: (*Image intensifiers (Electronic), Preparation), (*Photoelectric materials, Image intensifiers (Electronic)), (Luminescence, Image intensifiers (Electronic)), Cadmium compounds, Selenides, Powders, Photoconductivity, Impurities, Zinc, Copper, Oxygen, Noise, Hall effect, Films, Zinc compounds, Sulfides, Electric insulation, Magnesium compounds, Fluorides, Resolution, Light.

Work was started in purifying the best commercially available CdSe powder, and in studying the effect of Zn impurities on the photoelectronic characteristics of sintered CdSe layers. A literature search is being made on other new PC materials for possible use in the PC-EL image intensifiers. An effort was made to diminish the high noise level in the Hall-effect measuring device. Several batches of CdSe PC powders were made. The effect of copper and oxygen acceptor concentration was studied in these powders. Evaporated EL films were studied with MgF2 insulating layers above and/or below the EL films. Life tests on differently prepared EL films did not show any useful improvement. An increased effort in building high resolution image intensifiers was started. (Author)

AD-604 747 Div. 25, 2, 9
OTS Prices: HC $2.00/MF $0.50

Aerojet-General Corp., Downey, Calif.
INVESTIGATION OF THE COALESCENCE OF WATER DROPS.
Summary rept.,
by R. E. Brown. 14 Aug 64, 31p AGC-0817 01 01FP
Contract DA36 039AMC03378E

Unclassified report

Descriptors: (*Molecular association, Drops), (*Drops, Hydrodynamic configurations), (*Hhydrodynamic configurations, Drops), Raindrops, Fluid dynamic properties, Ammonia, Atmosphere, Gas flow, Chemical bonds, Surface properties, Viscosity, Evaporation, Humidity, Dust, Ionization, Ultraviolet radiation, Electrostatic fields.

The basic studies considered the coalecence of drops after contact under conditions simulating or exaggerating those conceivably prevalent in the atmosphere and in clouds. The major emphasis was in a search for additives to the drops and the air environment that would shorten the delay of coalescence. Many additives were investigated as reported earlier but no significant effects were observed except for the occasional shortening effects of ammonia in the environment. These results are difficult to evaluate in terms of a workable theory of coalescence.

AD-604 777 Div. 25
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.

Quarterly progress rept. no. 4, 8 Jan-8 Apr 64,
by J. W. Johnson. 30 Apr 64, 4p
Contract NObs88487, Projs. SR007 12 01, PAU4444
Unclassified report

Descriptors: (*Thermoelectricity, Materials), (*Semiconductors, Thermoelectricity), Energy conversion, Resistance (Electrical), Liquids, Copper compounds, Sulfides, Lead compounds, Measurement, Eutectics, High temperature research, Electrical conductance.

Measurements of the Seebeck coefficient and resistivity of the cuprous sulfide-lead sulfide system in the liquid state have been made for compositions containing 75, 70, 65, 60, and 25 mole percent cuprous sulfide. Preliminary results for this system indicate that Seebeck coefficient progresses smoothly from p-type at high cuprous sulfide compositions to n-type at high lead sulfide compositions passing through zero near the eutectic composition at 61 mole percent cuprous sulfide. Similar behavior, although not quite as distinct, is exhibited by the resistivity at constant temperature. (Author)

AD-604 923 Div. 25
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A NOTE ON THE DYNAMICS OF A DISORDERED LINEAR CHAIN,
by Richard Bellman. 3 Aug 55, 6p P-713
Unclassified report

Descriptors: (*Harmonic oscillators, Dynamics), (*Dynamics, Harmonic oscillators), Linear systems, Vibration, Distribution theory, Statistical functions, Algebra, Matrix algebra, Harmonic analysis.

By a disordered linear chain, we mean a chain of one-dimensional harmonic linear oscillators, each coupled to its nearest neighbors by harmonic forces, with the mass of each oscillator and the coupling parameters taken to be random variables with known distributions. The problem of calculating the distribution function of the frequencies of the normal modes of vibration of the chain in the limit as the chain becomes infinitely long was resolved by F. J. Dyson. This paper presents a simple algebraic proof of the essential limit relation in Dyson's paper. (Author)

AD-604 954 Div. 25, 2, 8
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE POWER SPECTRUM OF THE TURBULENT-SCATTERED FIELD,
by William C. Hoffman. 11 Oct 55, 16p P-749
Unclassified report

Descriptors: (*Electromagnetism, Refractive index), (*Refractive index, Electromagnetism), (*Turbulence, Electromagnetism), Electromagnetic waves, Electromagnetic fields, Partial differential equations, Dielectrics, Ionospheric propagation, Scattering.

The theoretical problem of wave motion in a medium which is isotropic but turbulent and whose index of refraction is a random function of position is discussed.

AD-605 016 Div. 25, 1, 12, 14
OTS Prices: HC $3.00/MF $0.75

RAND Corp., Santa Monica, Calif.
SURFACE-PROTECTION AND COOLING SYSTEMS FOR HIGH-SPEED FLIGHT,
by D. J. Masson and Carl Gazley, Jr. 23 Mar 56, rev. 16 Apr 56, 60p P-829
Unclassified report

Legibility of this document is in part unsatisfactory. Reproduction has been made from best available copy.

Descriptors: (*Aerodynamic heating, Heat transfer), (*Cooling and ventilating equipment, Flight), Heat-resistant materials, Cooling, Coatings, Heat shields, Guided missiles, Aircraft.

The high velocities proposed for various flight applications pose difficult problems in protecting the surface structure and internal compartments from the effects of severe aerodynamic heating rates. The paper discusses systems for surface protection against transient and continuous heat inputs, corresponding to typical missile and aircraft flight paths. Systems for transient heat loads can consist of heat sinks of various sorts, involving the absorption of heat by virtue of a material's sensible (temperature-rise) heat capacity, latent heat capacity, or chemical heat capacity. For steady-state or slowly varying heat inputs, systems for surface rotection and compartment cooling can be either of the passive or active types depending on the flight path and on compartment heat densities. Comparisons are made of various systems for several typical operating conditions. (Author)

AD-605 017 Div. 25
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE NATURE OF AXISYMMETRIC WAVE FIELDS IN ELASTIC SOLIDS,
by H. A. Lang. Rev. 2 Nov 56, 44p P-832
Unclassified report

Descriptors: (*Mechanical waves, Propagation), Solids, Elasticity, Harmonic analysis, Integral transforms, Stresses, Deformation, Acoustics, Fracture (Mechanics), Spallation, Explosion effects, Siesmic waves.

Expressions for the displacements established in an infinite half-space by a concentrated unit impulse which is a step function of time are determined by extending to the axially symmetric case, the procedure of F. Sauter's previously applied to the concentrated line shock in two dimensions. The results are used to prove that a pulse in acoustic material travels without dilatation, rotation, or acceleration. Some evidence is presented for the conjecture that wave transmission may depend upon the fact that Poisson's ratio is above or below a critical value. The importance of this basic problem to related problems in fracture initiation, spalling, explosive loads, seismology, wave reinforcements in plates of finite thickness is briefly noted.

AD-605 023 Div. 25
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ON THE PRINCIPLE OF INVARIANT IMBEDDING AND PROPAGATION THROUGH INHOMOGENEOUS MEDIA,
by Richard Bellman and Robert Kalaba.
10 Apr 56, 10p P-839
Unclassified report

Descriptors: (*Light, Scattering), (*Electromagnetic waves, Propagation), Invariance, Vector analysis, Transformations (Mathematics), Equations.

The purpose of the paper is to present a new technique

The ability of a gaseous vortex to contain a foreign gas within the core was evaluated. Carbon dioxide was injected axially, from exit to entrance, into the core of a vortex created by tangential injection of air into a vortex chamber. A suction tube in the back wall of the chamber was used to obtain the mixture in the core for chemical analysis. Carbon dioxide concentration in the core was measured at varying points of injection for vortex tube diameters of 1, 1 1/2 and 2 inches. Tests were conducted for four different flow rates of the vortex. It was found that carbon dioxide concentration decreased rapidly with axial distance from the point of injection, and maximum concentration at a given point generally decreased with an increase in the ratio of air mass flow to vortex tube diameter. (Author)

AD-604 833 Div. 25
OTS Prices: HC $3.00/MF $0.50

Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
HEAT TRANSFER FROM FIN-TUBE RADIATORS.
Master's thesis,
by Michael Francisco Sarabia. Jun 64, 66p
AFIT GAM/ME/64 16
Unclassified report

Descriptors: (*Heat transfer, Thermal radiation), (*Radiators, Heat transfer), Emissivity, Blackbody radiation, Meteors, Spacecraft, Thickness, Equations, Programming languages, Physical properties.

A FORTRAN language computer program is developed to calculate the radiation heat transfer characteristics of circular tubes with longitudinal fins. Mutual irradiation effects between the tubes and the fin are included. Arbitrary fin emissivity, fin thickness, and tube emissivity are also allowed in the program. The results indicate that the fin thickness effects are practically negligible and that, for equal fin and tube emissivities, the overall fin-tube efficiency is not proportional to the emissivity. For example, using for reference the black surface results, the use of an efficiency proportional to the emissivity would result in underestimating the efficiency by 14.4 percent in the case of a tube radius to fin length ratio of 1.0 and a fin-tube emissivity of 0.5. (Author)

AD-604 834 Div. 25
OTS Prices: HC $5.00/MF $1.00

Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
A CALORIMETRIC DEVICE FOR THE MEASUREMENT OF TOTAL HEMISPHERICAL EMITTANCE.
Master's thesis,
by Bobby R. Putnam. Jun 64, 156p
AFIT GAM/ME/64 15
Unclassified report

Descriptors: (*Calorimeters, Design), (*Thermal radiation, Measurement), Heat transfer, Emissivity, Thermodynamics, Thermocouples, Thermal conductivity, Disks.

Of the many different methods available for measuring total hemispherical emittance, the steady-state calorimetric method is the simplest and, potentially, the most accurate. A steady-state calorimetric device, designed for the measurement of total hemispherical emittance of thin flat disc specimens which are heated by thermal radiation from a hot wall, was evaluated over the emittance range of approximately 0.06 to 0.98. Equations were developed for the calculation of specimen emittance for which only temperatures need to be measured. Also, equations for determining the total heat loss (radiation plus conduction) through the disc thermocouple wires were developed. Thirteen specimens were evaluated, at temperatures ranging between 0F and 180F, to determine the accuracy of the apparatus. Experimental results, compared to theoretical and reported emittance data, prove the apparatus to be reliable for extremely accurate emittance measurements over the entire emittance range of 0.06 to 0.98. (Author)

AD-604 886 Div. 25
OTS Prices: HC $3.00/MF $0.75

Laboratories for Applied Sciences, Univ. of Chicago, Ill.
RESEARCH ON EFFECTS OF ARC FLUCTUATIONS ON SPECTROSCOPICALLY DETERMINED TEMPERATURES IN ARC PLASMAS.
Final rept. for May 63-May 64,
by Jay Burns. Jul 64, 74p
Contract AF33 657 10856, Proj. 7360, Task 736004
ML TDR64 243
Unclassified report

Descriptors: (*Plasma medium, Temperature), Electric arcs, Plasma jets, Turbulence, Spectroscopy, Optical equipment components, Plasma oscillations.

Results of time-resolved spectroscopic temperature measurements in small regions of a turbulent laboratory arc plasma generator are described. Techniques and instrumentation for carrying out time-resolved measurements are described. The effects of arc turbulence on apparent spectroscopic temperatures determined by conventional spectroscopic methods are demonstrated. The errors in average temperature measured by conventional spectroscopy as compared with the true average temperature in the same region of the arc determined by time-resolved spectroscopy are appreciable. No simple way was found to find true average temperatures in a turbulent arc plasma from apparent, conventional spectroscopic, average values. (Author)

AD-604 893 Div. 25
OTS Prices: HC $2.00/MF $0.50

Aerospace Corp., Los Angeles, Calif.
GENERAL RESEARCH. EXPERIMENTAL OBSERVATIONS OF KADOMTSEV INSTABILITY IN A HIGHLY IONIZED HELIUM PLASMA,
by D. A. McPherson. 31 Jul 64, 32p ATN-64(9230)-2
Unclassified report

Descriptors: (*Plasma oscillations, Electric currents), (*Magnetohydrodynamics, Plasma oscillations), Plasma medium, Helium, Mechanical waves, Damping, Polarization, Electrical conductance.

Experimental observations of the Kadomtsev current-convective interaction between a hydromagnetic wave and an electrical current were made using a highly ionized helium plasma to verify the theoretical analysis of Woods. According to theory, the damping of the wave should be modified by the addition of a term, the sign of which depends upon the sense of circular polarization of the wave. Data were taken to determine the dependence of this term upon electrical current, wave frequency, conductivity gradient, and wave polarization. In all instances, the experimental observations are in agreement with the theoretical predictions. (Author)

AD-604 914 Div. 25, 7
OTS Prices: HC $1.00/MF $0.50

Stanford Research Inst., Menlo Park, Calif.
THERMOELECTRIC MATERIALS.

Paper discussed was originally pub. in Philosophical Magazine (England) 1956, n.s. v.1.

Descriptors: (*Fatigue (Mechanics), Theory), Fracture (Mechanics), Crystal lattice defects, Creep, Surface properties, Stresses, Copper, Crystal structure.

AD-605 094 Div. 25
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
IMPURITY-INDUCED LOCALIZED MODES OF LATTICE VIBRATION IN A DIATOMIC CHAIN,
by Robert L. Bjork. 20 Sep 56, 22p P-943
Unclassified report

Descriptors: (*Crystal lattices, Vibration), Crystal lattice defects, Impurities, Diatomic molecules, Optical properties, Acoustic properties, Mathematical models, Vector analysis.

The normal modes of vibration and their associated frequencies are found for a diatomic chain containing an impurity of different mass and force constant than the atom which it replaces. Localized modes are found which have appreciable components only near the impurity and whose frequencies are displaced from the continua of the optical and acoustic bands into the forbidden gap or above the optical band. The number of localized modes, their general position (forbidden gap or above optical), and their symmetry (odd or even), engendered by any impurity are presented graphically. It is shown that when a strongly localized mode is present, other modes avoid the impurity. (Author)

AD-605 114 Div. 25
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ON THE PRINCIPLE OF INVARIANT IMBEDDING AND DIFFUSE RELECTION FROM CYLINDRICAL REGIONS,
by Richard Bellman and Robert Kalaba. 14 Nov 56, 8p P-976
Unclassified report

Descriptors: (*Electromagnetic waves, Reflection), Scattering, Diffusion, Cylindrical bodies, Spheres, Invariance, Vector analysis, Nonlinear differential equations.

It is shown that the principle of invariant imbedding (introduced in AD-605 023) permits the treatment of problems of radiative transfer from cylindrical and spherical geometries in a unitary fashion.

for the study of propagation through inhomogeneous and random media, based upon an invariance principle which is called the 'principle of invariant imbedding.' As an application, consideration is given to the problem of the scattering of light by an inhomogeneous medium of finite depth. The corresponding problem for homogeneous media was treated by Ambarzumian and Chandrasekhar. (Author)

AD-605 024 Div. 25
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
PROPERTIES OF THE SHOCK TRANSITION AT LOW TEMPERATURE,
by J. J. Gilvarry. 12 Apr 56, 16p P-840
Unclassified report

Descriptors: (*Shock waves, Thermodynamics), Entropy, Equations of state, Transformations, Gases, Solids, Atomic properties, Mathematical models.

Bethe's equation for the change of entropy in waves of finite amplitude is shown to be inapplicable for an initial state of temperature arbitrarily close to absolute zero for a substance possessing a zero-point pressure (or energy). Thermodynamic functions for such a substance at low temperature are formulated in general terms applicable to the Fermi-Dirac gas, the Thomas-Fermi atom, the Debye solid, and the Mie-Grüneisen solid as special cases. The conditions under which the equation of state satisfies the Bethe-Weyl conditions are given. Of the usual four basic properties of the shock transition under the Bethe-Weyl conditions, two must be modified for the class of substances in question, for an initial state arbitrarily close to zero temperature. The argument follows from extension of Bethe's method, by Taylor expansion of the Hugoniot function about the initial state. The results are shown to be consistent with Weyl's procedure. (Author)

AD-605 036 Div. 25, 17
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
AMPLITUDES OF THERMAL VIBRATION AT FUSION,
by J. J. Gilvarry. 1 May 56, 16p P-854
Unclassified report

Descriptors: (*Crystal lattices, Vibration), Metals, Melting, Thermodynamics, X-ray diffraction analysis, Crystal structure.

On the basis of theoretical results from the Debye-Waller theory of the thermal dependence of x-ray reflection intensity, relatively accurate values of the Lindemann constant are determined for ten metals by use of rigidity moduli at fusion with previously determined bulk moduli. Agreement of the derived value, RHO, of the critical ratio of root-mean-square amplitude of thermal vibration to nearest-neighbor distance at fusion, with the corresponding value from x-ray intensity data, is improved for the case (Al) favorable for comparison. The average value of RHO over the body-centered cubic, face-centered cubic, and hexagonal lattice types is 0-11 sub 1 in excellent agreement with the value 0.10 sub 5 given by Gruneisen. Relatively accurate values of the Lindemann constant for Pb and Al imply that this quantity can not be a strict constant over a lattice type; however, the assumption of an average over the lattice type yields an excellent approximation for the face-centered cubic elements. (Author)

AD-605 052 Div. 25
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ELASTIC STRESSES PRODUCED IN A HALF PLANE BY STEADILY MOVING LOADS,
by J. D. Cole and J. H. Huth. 21 Jun 56, 38p P-884
Unclassified report

Descriptors: (*Stresses, Load distribution), (*Load distribution, Dynamics), (*Elasticity, Theory), Mechanics, Shock waves, Mechanical waves, Strain (Mechanics), velocity, Dynamics, Equations, Integration, Partial differential equations.

A study is made of stresses and displacements induced in an elastic half plane (plane strain) by a concentrated line-load moving at a constant speed along its surface. The stress field for an arbitrary load distribution can be built up by superposition of these concentrated load solutions. Three cases are considered: the load is moving more slowly than either the longitudinal or transversal wave speeds of the elastic medium (subsonic case), the load speed is between the two wave speeds (transonic case), the load speed is greater than either wave speed (supersonic case). In each of these cases the nature of the singularity caused by the load is examined and the complete solution is given. (Author)

AD-605 059 Div. 25, 2
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
VARIATION OF THE AMPLITUDE OF THERMAL VIBRATION ON THE FUSION CURVE,
by J. J. Gilvarry. 11 Jul 56, 22p P-894
Unclassified report

Descriptors: (*Phase studies, Solids), (*Melting, Solids), (*Solids, Phase studies), Mathematical analysis, Heat of fusion, Entropy, Temperature, Pressure, Volume, Alkali metals, Tables, Geophysics, Crystal lattices, Thermal stresses, Vibration, Theory.

A differential relation, which is equivalent to the Debye-Waller identification of the Debye and Lindemann frequencies at fusion, is generalized to take into account variation along the fusion curve of the critical ratio of the root-mean-square amplitude of thermal vibration to the nearest-neighbor distance of the atoms in the solid at fusion. Thus extended, the theory yields an expression for the Gruneisen parameter of a solid at fusion in terms of fusion parameters and the rate of change of the critical ratio with respect to volume, which is valid for elements whose fusion curves have either normal or abnormal slopes. Values of derivatives of the critical ratio with respect to volume, temperature, and pressure at fusion are obtained for 16 elements. The results yield evaluations of the change in the critical ratio along the experimentally determined fusion curves for three alkali metals, and permit estimates in other cases. It is concluded that the assumption of a fixed Lindemann constant along the fusion curve of a particular element represents an excellent approximation, in general, for elements with normal fusion curves (for the case of classical excitation of the lattice vibrations). The same conclusion is obtained, within certain approximations, from the order-disorder theory of Lennard-Jones and Devonshire for the melting process, and the theory of Fisher for stability of the liquid phase. (Author)

AD-605 076 Div. 25, 17
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ON THE MECHANISM OF FATIGUE. A DISCUSSION OF A PAPER BY THOMPSON, WADSWORTH, AND LOUAT, PHILOSOPHICAL MAGAZINE, FEBRUARY, 1956,
by F. R. Shanley. 9 Aug 56, 10p P-920
Unclassified report

AD-604 437 Div. 26, 17
OTS Prices: HC $1.00/MF $0.50

IIT Research Inst., Chicago, Ill.
INTERFACE FRICTION IN HOT METAL DEFORMATION.
Bimonthly rept. no. 1, 23 May-23 Jul 64.
22 Aug 64, 7p IITRI-B6027-1
Contract NOw64 0458f
Unclassified report

Descriptors: (*Metals, Surface properties), (*Hot working, Metals), (*Friction, Hot working), Compressive properties, Deformation, Test equipment, Test methods, Sheets, Dies, Alloys, Refractory metals, Beryllium, Steel, Aluminum alloy.

An investigation of frictional phenomena encountered at the interface of tool and workpiece during the hot deformation processing of metals.

AD-604 560 Div. 26, 32
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ON THE OPTIMAL INVENTORY EQUATION,
by R. Bellman, I. Glicksberg, and O. Gross.
Rev. 28 Jul 55, 41p P-580
Unclassified report

Descriptors: (*Inventory control, Optimization), (*Optimization, Inventory control), Economics, Mathematical models, Operations research, Stock level control, Equations, Dynamic programming.

A number of functional equations which arise in the optimal inventory problem, the general problem of ordering in the face of an uncertain future demand, are discussed. Complete solutions are obtained for the case of an arbitrary number of items and arbitrary distribution of demand when the cost functions are taken proportional to the quantity ordered. (Author)

AD-604 615 Div. 26, 15, 32
OTS Prices: HC $3.00/MF $0.75

RAND Corp., Santa Monica, Calif.
INDUSTRY-WIDE, MULTI-INDUSTRY AND ECONOMY-WIDE PROCESS ANALYSIS,
by Harry Markowitz. 18 Nov 54, 64p P-600
Unclassified report

Descriptors: (*Industrial production, Mathematical analysis), (*Economics, Linear programming), (*Linear programming, Industrial production), Mathematical models, Petroleum industry, Management engineering.

Process analysis, as the term is used here, refers to the formal analysis of industrial productive processes. It consists of (a) the construction of a mathematical model which reflects the productive processes available to a firm, an industry, a group of industries or an economy; and (b) the use of this model to estimate, under various conditions, the capabilities of this firm, industry, group of industries or economy. An example of a subanalysis is presented to illustrate (a) how a technology can be expressed in linear programming terms, (b) the level of detail that is desired in the subanalyses, and (c) how a subanalysis may be used. The difficulties of, and the aids to, the building of an economy-wide model are discussed. An economy-wide process analysis model is compared with other economy-wide models. It also discusses what can and cannot be hoped for from an economy-wide process analysis.

AD-604 623 Div. 26, 15
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A PRODUCTION SMOOTHING PROBLEM,
by Selmer Johnson and George Dantzig. 6 Jan 55,
rev. 28 Feb 55, 29p P-610
Unclassified report

Descriptors: (*Production control, Mathematical programming), (*Scheduling, Production control), Operations research, Convex sets, Matrix algebra, Linear programming, Graphics, Theorems.

A single item is to be produced over a given number of time periods to satisfy known future requirements while minimizing costs where the costs per unit for production, storage, and change in production rate are known functions of time. While such a problem can be solved by regular linear programming methods, the novel feature here is that the primal and dual problems are solved jointly by means of a rapid graphical method involving only intersections and rotations of straight lines. The underlying reason for this stems from a special property of the near 'square block triangular' nature of the coefficient matrix. (Author)

AD-604 636 Div. 26, 15, 18
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A STOCKPILING PROBLEM: MATHEMATICAL TREATMENT,
by J. M. Danskin. 23 Feb 53, 19p P-634
Unclassified report

Descriptors: (*Strategic materials, Mobilization), (*Stock level control, Mathematical analysis), Industrial production, Costs, Theorems, Probability, Functions.

AD-604 675 Div. 26, 15, 32
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
SOME STATISTICAL PROPERTIES OF SELECTED INVENTORY MODELS,
by Murray A. Geisler. Dec 61, 31p P2502
Unclassified report

Descriptors: (*Inventory control, Statistical processes), (*Statistical processes, Inventory control), (*Mathematical models, Inventory), Analysis of variance, Correlation techniques, Management engineering, Equations, Numerical methods and procedures.

In the study of inventory policies an interest is shown not only in the mean values of such important random variables as number of shortages per time period, but also in their variance and covariance properties. Such additional properties are of interest in interpreting the stability of an expected value, under assumed inventory policies and parameters, and in using stochastic or Monte Carlo models to calculate estimates of the expected values by sampling techniques. In this paper, comparatively simple inventory models are examined and the expected value, variance, and selected covariance and correlations of the random variables representing stock on hand, shortages per period, overages per period and reorder quantity are derived. (Author)

AD-604 729 Div. 26, 17
OTS Prices: HC $3.00/MF $0.75

General Electric Co., West Lynn, Mass.

26. Production and Management

AD-604 374 Div. 26, 1
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
STATUS PREDICTION OF SCHEDULED EQUIPMENT,
by Robert E. Johnson and Bernard J. Marks.
Aug 61, 38p P-2435
Unclassified report

Prepared in cooperation with Southern Illinois Univ., Carbondale, Ill.

Descriptors: (*Scheduling, Management control systems), Probability, Operations research, Mathematical models, Matrix algebra, Stochastic processes, Control, Aircraft.

This paper describes a method of predicting the status of equipment and an experiment that was performed in order to gain experience with the method. In the prediction model, the movement of units of equipment from one state to another is governed not only by the transition probabilities of a Markov chain, but also by a control process that is called 'scheduling'. In scheduling, reassignments of equipment from certain states to others are planned for various future times. Because the number of units actually available for reassignment is a random variable, 'expected reassignments' are used in determining equipment status at each successive stage in the prediction process. Expected reassignments are used to modify equipment status at the beginning of the period and then the transition probabilities of a Markov chain are used to determine the status of equipment at the end of the period. Using the resulting predictions, the decision-maker is in a position to evaluate the future performance of the system and adjust his schedule accordingly. (Author)

AD-604 382 Div. 26
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
METHODOLOGY FOR RELIABLE FAILURE REPORTING FROM MAINTENANCE PERSONNEL,
by F. A. Hadden and L. W. Sepmeyer. 15 Jul 54, 9p
P-545
Unclassified report

Descriptors: (*Management engineering, Maintenance), (*Maintenance personnel, Reliability), Failure (Mechanics), Malfunctions, Reports.

The work described in this paper is based upon experience gained at a United States Air Force installation, but it is clear that many of the concepts which emanate from the consideration of the human factors involved are applicable to getting failure data in industrial and other organizations. Consideration of field conditions forces one to the conclusion that the maintenance technician is the only practical source of the required failure or malfunction data, except for very special projects where it may be practical to have a large number of people assigned specifically to the job of taking data. The basic problem is how to make the maintenance man a reliable link in the failure reporting process. The lessons learned from this field trial are not black or white rules that must be rigorously adhered to, but rather a set of four basic principles, each of which contributes to a successful reporting system. The four principles are (1) consideration of human factors, (2) payment for the data in a tangible way, (3) delegation of responsibility for reporting to the lowest possible organizational level, (4) design of the reporting form for the maintenance man. Each of these principles are discussed.

AD-604 397 Div. 26, 10, 32
OTS Prices: HC $3.00/MF $0.75

RAND Corp., Santa Monica, Calif.
A LINEAR PROGRAMMING MODEL OF THE U. S. PETROLEUM REFINING INDUSTRY,
by Alan S. Manne. Rev. 16 May 56, 85p P-563
Unclassified report

Descriptors: (*Linear programming, Scheduling), (*Petroleum industry, Mathematical models), (*Refineries, Mathematical models), (*Scheduling, Petroleum industry), Economics, Petroleum, Transportation, Geography, Operations research, Sampling, Matrix algebra, Production, Processing, United States.

This paper reports upon the construction of one of a series of process analysis models that are being developed for the United States economy. The general purpose of these studies is to give numerical answers to questions about production capability, and at the same time to take account of potential substitutions between alternative production processes.

AD-604 402 Div. 26, 32
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ON THE OPTIMAL INVENTORY EQUATION,
by Richard Bellman, Irving Glicksberg, and Oliver Gross. 28 Sep 54, 7p P-572
Unclassified report

Descriptors: (*Inventory control, Optimization), Mathematical models, Dynamic programming, Theory, Costs, Economics, Equations.

A summary is presented of some results recently obtained in connection with the problem of optimal inventory. Solutions are given for the case of proportional costs and arbitrary demand, and for the case where the costs are linear constant terms representing administrative costs. (Author)

AD-604 403 Div. 26, 8
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
TECHNIQUES IN PUTTING FAILURE DATA TO WORK FOR MANAGEMENT,
by F. A. Hadden and L. W. Sepmeyer. 30 Sep 54,
21p P-573
Unclassified report

Descriptors: (*Reliability (Electronics), Reports), (*Management control systems, Reliability (Electronics)), Electronic equipment, Spare parts, Mathematical analysis, Logistics, Programming (Computers), Statistical data, Punched cards, Malfunctions.

An extended field study was made of methods of failure reporting and of machine reduction, analysis, and presentation of failure data. The paper presents the results of this study, and shows how a field failure reporting system can be used as a tool for control of equipment reliability. The system developed as a result of the field study is described in some detail. The discussion in the body of the text covers report and presentation forms; techniques of gathering, analyzing, and presenting the data; mathematical considerations on which the analysis is based; and management's use of the data to improve reliability and spare parts supply. Appendices provide more detailed statements on these topics, including an abstract of the machine procedures required to produce the tabulations illustrated.

AD-604 902 Div. 26, 17, 25
OTS Prices: HC $2.00/MF $0.50

Whirlpool Corp., St. Joseph, Mich.
THERMOELECTRIC JUNCTIONING PROJECT.
Progress rept. no. 7, 1 Oct-31 Dec 63,
by James E. Robinson. 31 Jan 64, 28p
Contract NObs86483, Proj. SR007 12 01, Task 806
Unclassified report

Descriptors: (*Thermoelectricity, Materials), (*Plating, Thermocouples), (*Joining, Thermocouples), (*Soldering, Thermocouples), Bismuth alloys, Tellurium alloys, Surface properties, Metal films, Nickel, Rhodium, Tin, Electroplating, Soldering alloys, Soldering fluxes, Diffusion, Aging (Materials), Cleaning, Vacuum apparatus, Semiconductors, Intermetallic compounds.

Working during the seventh quarterly period included experimentation with sputtered nickel, rhodium, and tin films on thermoelectric materials and improvements in electrolytic nickel plating techniques. Diffusion and the effect of high temperatures for extended time were also investigated. A high vacuum system operating above room temperature was investigated for precleaning thermoelectric elements prior to junctioning. (Author)

AD-604 903 Div. 26, 17, 25
OTS Prices: HC $1.00/MF $0.50

Whirlpool Corp., St. Joseph, Mich.
THERMOELECTRIC JUNCTIONING PROJECT.
Progress rept. no. 8, 1 Jan-31 Mar 64,
by James E. Robinson. 30 Apr 64, 20p
Contract NObs86483, Proj. SR007 12 01, Task 806
Unclassified report

Descriptors: (*Thermoelectricity, Materials), (*Joining, Thermocouples), Bismuth alloys, Tellurium alloys, Electroplating, Nickel, Diffusion, Soldering alloys, Tin alloys, Antimony alloys, Lead alloys, Copper, Tin, Heat treatment, Semiconductors, Soldering, Aging (Materials), Plating, Intermetallic compounds.

Work during the eighth quarterly period included experimentation with improvements in electrolytic nickel plating bismuth-telluride thermoelectric materials and diffusion characteristics of various solders in bismuth-telluride thermoelectric materials. (Author)

AD-604 953 Div. 26, 32
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A FRUITFUL APPLICATION OF STATIC MARGINAL ANALYSIS,
by H. W. Karr and M. A. Geisler. 10 Oct 55,
34p P-748
Unclassified report

Descriptors: (*Management planning, Decision making), (*Economics, Statistical analysis), Probability, Statistical analysis, Consumption, Logistics, Spare parts, Inventory management, Personnel management, Electronic equipment.

The paper describes the application of the technique of simple 'marginal analysis' to an Air Force problem and suggests that a similar application may be useful in many industrial situations. Examples of such industrial problems are also presented. The class of problems discussed can be described as those in which the demand or need for each of several alternative commodities during a specified period of time can be expressed in terms of a probability distribution. Given that the needs can only be met from a package of such commodities of specified total cost, the problem is to select the composition of commodities to be put into the package so that the number of unsatisfied demands or shortages will be minimized. (Author)

AD-604 970 Div. 26, 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
NOTES ON THE THEORY OF DYNAMIC PROGRAMMING---VI. THE WAREHOUSING MODEL,
by Richard Bellman. 29 Nov 55, 8p P-773
Unclassified report

Descriptors: (*Stock level control, Mathematical models), (*Dynamic programming, Stock level control), (*Scheduling, Stock level control), Optimization, Equations, Warehouses, Inventory control, Management engineering, Operations research.

The purpose of this paper is to show how the functional equation technique of the theory of dynamic programming yields a very simple computational algorithm for the solution of mathematical models arising in stock level studies. A numerical solution of these problems relying upon linear programming techniques had previously been given by Charnes and Cooper. (Author)

AD-604 985 Div. 26, 17
OTS Prices: HC $4.00/MF $0.75

Massachusetts Inst. of Tech., Cambridge. Div. of Sponsored Research.
WELD CRACKLING IN SUBMARINE STEELS.
Final rept.,
by R. E. Travis and C. M. Adams, Jr. Jun 64, 126p
Contract NObs88370, Proj. SR007 01 01, Task 855
Unclassified report

Descriptors: (*Welds, Steel), (*Steel, Welding), Submarines, Quality control, Fracture (Mechanics), Welding fluxes, Thermal properties, Mechanical properties, Metallography, Instrumentation.

The report describes results of a research program directed to the behavior of submarine steels when welded under conditions of hindered thermal contraction. The principal objectives of the investigation have been to make quantitative or semi-quantitative assessments of procedural and compositional factors in the development of residual stresses or cracking in or near welds cooling while subjected to external restraint, the external restraining apparatus being so instrumented as to give continuous information on the magnitudes of bending moment and separating force to which the welds are subjected. A further objective has been to refine and compare different types of instrumented restraining apparatus to the end of developing the most sensitive and meaningful tests possible for evaluating and comparing materials and procedures from the standpoints of how they influence stress buildup and cracking.

AD-605 010 Div. 26, 1
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
MAINTENANCE OF A GROUP OF MACHINES UTILIZED INTERMITTENTLY AND SUBJECT TO SEVERAL TYPES OF MALFUNCTIONS. I. OPERATIONAL REQUIREMENTS AND RESOURCE ALLOCATIONS,
by W. P. Sewell. 19 Apr 56, 10p P-818
Unclassified report

HYDRODYNAMIC COMPRESSIVE FORGING.
Final rept. for 9 Jul 62-1 Jul 64,
by Richard M. Cogan. Jul 64, 90p
Contract AF33 657 8793, Proj. 7 890
ML TDR64 240

Unclassified report

Descriptors: (*High pressure research, Forging), (*Forging, Hydrostatic pressure), (*Hydroforming (Mechanics), Forging), Manufacturing methods, Dies, Hydrodynamics, Compressive properties, Deformation, Chromium alloys, Aluminum, Carbon alloys, Steel, Nickel alloys, Iron alloys, Martensite, Anisotropy, Titanium alloys, Molybdenum alloys, Structural properties, Loading (Mechanics), Extrusion, Dies, Temperature, Stresses, Vanadium alloys.

A manufacturing process development for the production of closed die forgings using hydrodynamic compressive forces at room temperatures is described. Upsetting materials in a cavity first filled with a low strength matrix increases the amount of plastic deformation obtained prior to fracture. The forces necessary to deform materials in this manner can be predicted from the extrusion force required for operation plus what is necessary to overcome the hydrostatic pressure developed by the resistance of the matrix to flow. The materials worked in this program were: a low alloy carbon steel, AISI-4340; a cast nickel base high temperature alloy, SEL-15; an iron base face centered cubic precipitation hardening alloy, A-286; an iron base martensite precipitation hardening alloy, AM-355; a hexagonal close pack (anisotropic) alloy, 6A1-4V titanium; and a body centered cubic refractory alloy, .5Ti molybdenum. Micro and macro examinations of the materials showed the parts produced in this manner to be structurally comparable to conventional cold worked metals. A modification of this method using a doughnut shaped billet filled with a matrix material reduced the die loading stresses. As a consequence, higher strength materials were worked in this manner. (Author)

AD-604 875 Div. 26, 17, 31
OTS Prices: HC $1.00/MF $0.50

United States Steel Corp., Monroeville, Pa.
EVALUATION OF 2-INCH-THICK ELECTRON-BEAM WELDMENTS.
Technical rept.,
by L. P. Connor and A. M. Rathbone. 1 Jul 64, 42p
Contract NObs88540, Projs. 40 018 002 18, SS050 000, Task 1567

Unclassified report

Descriptors: (*Welding, Steel), (*Steel, Welding), (*Submarine hulls, Welding), Electron beams, Thermal joining, Welds, Nickel alloys, Chromium alloys, Molybdenum alloys, Vanadium alloys, Metal plates, Tensile properties, Ductility, Toughness, Fracture (Mechanics), Mechanical properties, Microstructure.

Sample electron-beam weldments were fabricated from 2-inch-thick 12Ni-5Cr-3Mo steel plates (at a 180 ksi yield strength) and also from 2-inch-thick 5 1/4Ni-Cr-Mo-V steel plates (at a 140 ksi yield strength) by using the low-voltage (Sciaky) process and also using the high-voltage (Hamilton-Standard) process. Radiographic and metallographic inspections disclosed that all the weldments contained defects such as lack of penetration, lack of fusion, porosity, and/or microcracks. The results of mechanical-property tests of the 5 1/4Ni-Cr-Mo-V weldments indicated that, in flaw-free regions, the electron-beam weldments exhibited good strength and ductility, moderately good weld-metal toughness, and excellent heat-affected-zone toughness. The results of the mechanical-property tests of aged 12Ni-5Cr-3Mo weldments indicated that, in flaw-free regions, the electron-beam weldments exhibited adequate strength but low weld-metal and weld-heat-affected-zone toughness. Generally, the evaluation of the 2-inch-thick electron-beam weldments--both the 140-ksi yield-strength 5 1/4Ni-Cr-Mo-V weldment and the 180-ksi yield-strength 12Ni-5Cr-3Mo weldment--indicated that no metallurgical advantages were derived from electron-beam welding that could not be achieved by using more conventional welding processes.

AD-604 887 Div. 26, 17
OTS Prices: HC $0.75/MF $0.50

Rock Island Arsenal Lab., Ill.
EVALUATION OF THE ROCKWELL 'C' 70 HIGH SPEED STEEL CUTTING TOOLS.
Technical rept.
by G. F. Wilson. 8 Jun 64, 48p
Proj. 466FY62
RIAL 64 1889

Unclassified report

Descriptors: (*Cutting tools, Tool steel), (*Tool steel, Cutting tools), Hardness, Steel, Chromium alloys, Molybdenum alloys, Vanadium alloys, Hot working, Performance (Engineering), Heat treatment, Machining, Life expectancy, Wear resistance, Heat resistant metals and alloys, Cobalt alloys.

Six grades of cutting tools, five of Rockwell 'C' 70 high speed steel and one of 'super' grade high speed steel, were evaluated for the turning of Class H 11, chromium-molybdenum-V hot work tool steel heat treated to Rockwell 'C' 50. Performance of four grades exceeded that of the other two by a significant margin. Selection from the four grades will depend on the particular application. Consideration will have to be given to grinding cost, conditions for minimum machining costs and requirements for maximum production. (Author)

AD-604 901 Div. 26, 17, 25
OTS Prices: HC $2.00/MF $0.50

Whirlpool Corp., St. Joseph, Mich.
THERMOELECTRIC JUNCTIONING PROJECT.
Final rept.
by James E. Robinson. 15 Jul 64, 39p
Contract NObs86483, Proj. SR007 12 01, Task 806

Unclassified report

Descriptors: (*Thermoelectricity, Materials), (*Joining, Thermocouples), (*Plating, Thermocouples), (*Soldering, Thermocouples), Cleaning, Surface properties, Soldering fluxes, Soldering alloys, Bismuth alloys, Tellurium alloys, Antimony alloys, Tin alloys, Semiconductors, Electroplating, Nickel, Diffusion, Degradation, Metal films, Lead alloys, Rhodium, Aging (Materials), Intermetallic compounds.

Various methods of surface cleaning the n- and p-type Peltier materials produced no difference in solderability of the materials. Also no increase in solderability was noted with the use of any specific flux tested. The acid fluxes were the easiest to work with from the standpoint of flux residues. A fairly thorough surface analysis did not reveal any surface contaminant that could be expected to inhibit solderability of the thermoelectric materials. It was discovered that antimony is a necessary constituent in the bismuth-tin solders to achieve adhesion to the as-received surfaces of the bismuth-telluride thermoelectric materials. An electrolytic nickel plating system was developed that enabled consistent and uniform nickel plating of the thermoelectric materials and resulted in good adhesion of the nickel plating to the thermoelectric materials. The nickel plated materials could be soldered with many different solders and provided a wide spectrum of possible junction operating temperatures. (Author)

27. Propulsion Systems

AD-604 365 Div. 27, 10
OTS Prices: HC $5.00/MF $1.00

Dynatech Corp., Cambridge, Mass.
ZERO GRAVITY CONTROL OF HYDROGEN AND CESIUM BY ELECTRICAL PHENOMENA.
Final rept. for Mar 63-Feb 64,
by Mathew Hurwitz, E. John Fahimian, and John M. Reynolds. Apr 64, 193p Dynatech-455
Contract AF33 657 10784, Proj. 3141, Task 314105
APL TDR64 46

Unclassified report

Descriptors: (*Space propulsion, Fuel systems), (*Fuel systems, Space propulsion), (*Rocket propellants, Storage), Liquefied gases, Hydrogen, Separation, Electrophoresis, Flight tests, Payload, Control systems, Magnetohydrodynamics, Liquid metals, Cesium, Weightlessness, Ion engines.

Investigations established the feasibility of dielectrophoretic separation and orientation of two-phases hydrogen in long-duration, large-scale, zero-g storage facilities. Laboratory analog tests were conducted which verified theoretical performance criteria. KC-135 flight tests demonstrated the validity of the analog results. A generalized computer-aided program was instituted for designing dielectrophoretic storage systems optimized with respect to weight penality. The total weight penalty for a typical, 4000 lb, voltage and frequency optimized dielectrophoretic orientation device is less than 2% of the payload. The electrical power level is 141 watts intermittently applied for approximately 1% of the mission time -- during venting or vapor delivery for propulsion system restarts. Electrohydrodynamic (EHD) and Magnetohydrodynamic (MHD) phenomena were investigated for control of liquid cesium. EHD methods are not feasible. Several MHD methods were investigated. Only the traveling-wave induction machine satisfies the requirements for cesium control in zero-g. Theory for the cylindrical machine was derived and laboratory performance with mercury was demonstrated at the force levels required for control of cesium against 0.001 g in an interesting type of ion propulsion feed system. (Author)

AD-604 428 Div. 27, 25
OTS Prices: HC $4.00/MF $0.75

Charged Particle Research Lab., Univ. of Illinois, Urbana.
ELECTRICAL SPRAYING OF MACROSCOPIC LIQUID PARTICLES UNDER PULSED CONDITIONS,
by Ralph S. Carson. 15 Jan 64, 112p CPRL-1-64
Grants AF AFOSR 107 63, NSF G19776
AFOSR 64 1470

Unclassified report

Descriptors: (*Electric propulsion, Sprays), (*Sprays, Electric propulsion), Colloids, Drops, Charged particles, Alcohols, Phthalates, Oscillation, Voltage, Electrostatics, Mass spectroscopy, Photomicrography.

The work pertains to the production of electrically charged macroscopic liquid particles by means of electrical spraying. An historical treatment is used to point out that an important application of electrical spraying is in the electrical propulsion field. It was found that glycerine, Octoil, and Octoil doped with tetra-n-butylammonium picrate readily spray from the end of a fine capillary, maintained at a high d-c potential, in short periodic bursts which continue over a prolonged time interval of at least several hours. New techniques are presented for determining the specific-charge spectra of the droplets emitted in selected intervals during the spraying pulses by time-of-flight mass spectrometry, and for taking photomicrographs of the liquid surface at any instant before, during, and after the spraying pulses. A method for synchronizing the spraying to an external pulser is indicated. Calculations based on considerations of the time intervals between spraying pulses, their widths, and period-to-width ratios are compared with measured values and reasonable agreement is achieved.

AD-604 507 Div. 27, 12, 17
OTS Prices: HC $1.00/MF $0.50

Space Technology Labs., Inc., Los Angeles, Calif.
PRESSURE VESSEL DESIGN CRITERIA.
Semi-annual rept. for 1 Jul-31 Dec 58,
by Donald P. Fitzgibbon. 31 Dec 58, 24p
STL GM-TR-0165-00583
Contract AF04 647 165

Unclassified report

Descriptors: (*Rocket cases, Guided missile components), (*Pressure vessels, Rocket cases), (*Guided missiles components, Rocket cases), Guided missiles (surface-to-surface), Steel, Ductility, Fracture (Mechanics), Strain (mechanics), Stresses, Tensile properties, Heat treatment, Experimental data, Specifications, Design.

The purpose of the work being performed in this program was to provide experimental data to assist in establishing material selection and design and fabricatfon criteria for reliable, highly efficient pressure vessels. Preliminary values of ductility of 4340 steel were obtained from fracture strain measurements of narrow-bend and wide-bend specimens, and reductions of useful strength of offset tensile specimens were measured at several nominal strengths. Correlation of the reduction of wide bend fracture strains with the reduction of useful strength of offset tensile specimens at increasing nominal uniaxial strength levels was indicated. The 4340 steel under consideration exhibited higher ductility, both in the uniaxial and biaxial stress states, than had been anticipated from previous tests. (Author)

AD-604 523 Div. 27
OTS Prices: HC $3.00/MF $0.75

Philco Research Labs., Newport Beach, Calif.
AN INVESTIGATION AND DEVELOPMENT OF FILM PROTECTED-CONVECTIVELY COOLED NOZZLES.
Quarterly technical rept. no. 2,
by R. L. Mitchell, H.L. Moody, A. M. Saul and W. L. Smallwood. 20 Aug 64, 99p U-2736
Contract AF04 611 9705
RPL TDR64 124

Unclassified report

AD-602 499.

Descriptors: (*Rocket motor nozzles, Design), Cooling, Protective coverings, Films, Coolants, Carbon tetrachloride, Methane, Injection, Thermochemistry, Chemical analysis, Heat transfer, Turbulent boundary layer, Fluid mechanics, Aluminum compounds, Oxides, Thermal radiation, Rocket motors (Solid propellant), Captive tests.

Presented is a summary of the analytical and experimental effort to investigate and develop a film protected, convectively cooled nozzle for advanced solid rocket applications. The work performed included thermochemical analyses of the reactions encountered in the boundary layer between the injectant, the free stream, and

Descriptors: (*Queueing theory, Machines), (*Aircraft, Maintenance), Operations research, Malfunctions, Spare parts, Costs, Management planning.

Consideration is given to the kinds of modifications of the 'standard' queueing models required to deal with the complex allocation problems involved in cycling aircraft through maintenance with the malfunction and service rates dependent on the number and use of in-commission aircraft.

AD-605 011 Div. 26
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
SOME QUEUING PROBLEMS IN MACHINE MAINTENANCE,
by D. S. Stoller. Rev. 12 Sep 56, 10p P-819
Unclassified report

Descriptors: (*Queuing theory, Machines), (*Machines, Maintenance), Operations research, Malfunctions, Probability, Management planning, Scheduling.

The paper discusses some queuing problems that arise in the context of the maintenance of a group of machines, each of which is operated intermittently, and all of which are subject to several kinds of malfunctions. A general formulation of this problem is made and the general method of solution indicated. A class of solutions in form suitable for direct computations is given. As a special case, a solution is given to the case of m sub j repairmen of type j, j = 1, . . . , k for a group of fully utilized machines. (Author)

AD-605 085 Div. 26, 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
AN ANALYTIC SOLUTION OF THE WAREHOUSE PROBLEM,
by Stuart E. Dreyfus. 6 Sep 56, 10p P-932
Unclassified report

Descriptors: (*Stock level control, Mathematical models), (*Dynamic programming, Stock level control), (*Scheduling, Stock level control), Recursive functions, Optimization, Equations, Theorems, Warehouses, Inventory control, Operations research.

This paper uses dynamic programming to establish a computational algorithm for the solution of the 'warehouse' problem and shows that the structure of the solution can be determined analytically, with numerical results easily obtained via recursive formulas.

AD-605 093 Div. 26, 15, 30, 32
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE COMBINATION OF TIME SERIES AND CROSS-SECTION DATA IN INTERINDUSTRY FLOW ANALYSIS,
by Kenneth J. Arrow. 18 Sep 56, 12p P-942
Unclassified report

Prepared in cooperation with Stanford Univ., Calif.

Descriptors: (*Industrial production, Mathematical analysis), (*Economics, Mathematical models), (*Mathematical models, Economics), Distribution (Economics), Time studies, Partial differential equations, Numerical analysis, Matrix algebra.

A problem which arose in the course of a larger study to explain the variations of input-output ratios over time is considered. (By the input-output ratio of industry 'i' to industry 'j' is meant the ratio of that part of the output of industry 'i' used by industry 'j' to the output of industry 'j'. For such a study, there are two types of data available. For all years, there are available (ideally) outputs and final demands (the final demand for an industry consists of all uses of its product other than in other industries or itself) for all industries. The 'balance equations' of input-output analysis form an (incomplete) system of simultaneous relations which may be estimated by some version of the method of maximum likelihood (for computational resons, the single-equation limited-information method is the only one likely to be used). However, for some years, additional information is gained in the form of knowing the actual interindustry flows, which clearly should substantially increase the accuracy of the estimates. The simplest technique is, of course, to assume that the 'true' input-output ratio for any year for which flow data are available is exactly equal to the observed input-output ratio for that year. The assumption behind this is, however, contradictory to the basic postulate that all the relations involved are valid only up to a stochastic term. It is therefore of interest to consider more explicitly the interindustry flow model implied in the use of both time series and interindustry flow data for estimating the parameters involved. (Author)

AD-605 121 Div. 26
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
SEQUENTIAL PRODUCTION PLANNING OVER TIME AT MINIMUM COST,
by S. M. Johnson. Rev. 4 Feb 57, 10p P-989
Unclassified report

Descriptors: (*Management planning, Combinatorial analysis), (*Scheduling, Production), Time, Costs, Sequences, Storage, Functions, Game theory.

Production of a given commodity is to be scheduled over time to meet known future requirements while minimizing total costs. The costs include both storage and production costs as functions of time. The unit production cost is an increasing function of the production rate. Previous solutions to this problem involved complicated iterative procedures. A new approach brings out the basic principle involved and leads to a simple solution. This coincides with a common-sense technique sometimes used in business. (Author)

locations were at the furnace exit, screen exit, superheater cavity, superheater exit, in the generating bank, at the generating bank exit and at the economizer exit. Operation was conducted at various boiler steaming rates, excess air and burner combinations. Information was obtained concerning the effects of boiler steaming rate, excess air and burner combination on gas temperature and heat absorption in the various boiler sections. (Author)

the nozzle wall; heat transfer analyses on alumina particle radiation and convection heat transfer to the nozzle wall; fluid mechanics analysis of injection into a turbulent boundary layer with accelerating flow; cold flow laboratory experiments on injection into a turbulent boundary layer through discrete holes; and rocket motor tests of the cooling concept on a solid propellant simulator. (Author)

AD-604 583 Div. 27, 10
OTS Prices: HC $5.00/MF $1.00

Charged Particle Research Lab., Univ. of Illinois, Urbana.
PARAMETERS INFLUENCING THE CHARGE-TO-MASS RATIO OF ELECTRICALLY SPRAYED LIQUID PARTICLES,
by James J. Hogan. 15 Dec 63, 187p CPRL 2 63
Grants NSF G19776; AF AFOSR107 63
AFOSR 64 1478, N64 20822

Unclassified report

Descriptors: (*Electric propulsion, Sprays), (*Sprays, Electric propulsion), (*Atomization, Electrostatics), Colloids, Drops, Charged particles, Alcohols, Particle beams, Measurement, Capillary tubes, Mass spectroscopy, Space charges, Electrical conductance, Temperature, Thermodynamics, Rocket propellants.

The problem in the study was to investigate the parameters influencing and the mechanisms involved in the electrical atomization process, i.e., in the process by which liquid surfaces are broken up into small, charged particles as the result of electrostatic forces. Electrical atomization was studied primarily by measuring the charges, masses, velocities, and charge-to-mass ratios (specific charge) of the particles in the beams thus generated. A theoretical study of the electrical dispersion process is presented. The study includes: (1) Surface energy minimization of the dispersed system of particles, (2) Solution of Poisson's equation and the influence of space charge on the specific charge of the emitted particles, and (3) the influence of the conductivity and temperature of the liquid on the generation of charged particles. It is proposed that an equilibrium is established among the voltage drop across the liquid meniscus at the capillary tip, the space charge in the vicinity of the source, and the surface energy minimization process -- and that the specific charge of emitted drops is established as a result of this equilibrium.

AD-604 741 Div. 27
OTS Prices: HC $5.00/MF $1.00

Airesearch Mfg. Co., Phoenix, Ariz.
GEM PROPULSION SYSTEM STUDY.
Engineering rept.,
by W. Norgren, G. Perrone, and Y. Senoo. 5 May 64, 166p AP-5072-R
Contract Nonr3024 00

Unclassified report

Descriptors: (*Ground effect machines, Propulsion), (*Ducted fans, Ground effect machines), Axial flow fans, Impellers, Duct inlets, Design, Nozzles, Jet vanes, Pneumatic systems, Diffusers, Shroud rings, Test equipment.

The study effort investigated three areas: (a) design fabrication, and test of a fan that is suitable for most Ground Effect Machines; (b) comparative study of base jet-nozzle geometries; (c) comparison of the pneumatic interconnection between the fan and the base jet nozzles. An important improvement in internal efficiency can be achieved with the proper integration of these three factors, combined with the vehicle design necessary to perform the required mission. (Author)

AD-604 812 Div. 27, 8, 12, 21
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
POWER IN SPACE,
by J. H. Huth. 26 May 58, 14p P-1389

Unclassified report

Invited paper for pub. in Astronautics.

Descriptors: (*Space propulsion, Power supplies), (*Spacecraft, Power supplies), Rocket propulsion, Spacecraft nuclear propulsion, Thermonuclear reactions, Annihilation reactions, Solar sails, Solar cells, Radioactive batteries, Fuel cells, Reviews.

AD-604 824 Div. 27, 12
OTS Prices: HC $4.00/MF $1.00

Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
ANALYTICAL INVESTIGATION OF ROCKET ENGINE PERFORMANCE DEGRADATION DUE TO THE PRESENCE OF AN INERT DILUENT.
Master's thesis,
by Fredrik E. Anderson. Jun 64, 138p
AFIT GAM/ME/64 1

Unclassified report

Descriptors: (*Rocket motors (Liquid propellant) Performance (Engineering)), (*Nitrogen, Fuel additives), Rocket propellants, Liquid rocket oxidizers, Hydrogen, Oxygen, Rocket motor nozzles, Exhaust gases, Programming (Computers), Thermodynamics, Velocity, Analysis, Thrust, Equations.

The primary purpose of the investigation was to determine the degration of theoretical rocket engine performance which results from the introduction of nitrogen as an inert diluent into the oxidizer of the hydrogen-oxygen propellant combination. Also, the actual performance which can be attained in a rocket motor with such propellants was explored. A program for computation of theoretical performance was written for the IBM 1620 Data Processing System. The rocket performance parameters of characteristic velocity, thrust coefficient and specific impulse were calculated. Theoretical performance was computed and analyzed for chamber pressures of 300 and 150 psia at a nozzle area ratio of 4.00:1 over a range of mixture ratios from 0.15 to 0.50 of stoichiometric for nitrogen fractions of 0, 0.20, 0.40, 0.60 and 0.75. Characteristic velocity for a nitrogen fraction of 0.75 indicated a degradation to 60-63% of the pure oxygen value at the same equivalence ratio. (Author)

AD-604 895 Div. 27, 13
OTS Prices: HC $3.00/MF $0.75

Naval Boiler and Turbine Lab., Philadelphia, Pa.
HEAT TRANSFER STUDIES OF THE DLG-6 BOILER.
Final rept.,
by E. T. Mitnaul. 31 Jul 64, 88p
Proj. SF013 06 16, Task 4177
NBTL B505

Unclassified report

Descriptors: (*Boilers, Heat transfer), (*Heat transfer, Boilers), Steam, Air, Temperature, Velocity, Furnaces, Gas flow, Marine propulsion.

Heat transfer data were obtained for the DLG-6 test boiler. The data included gas temperatures and gas velocity profiles. The data were obtained by extending probes into the boiler at 15 pertinent locations. These

CROSS-CULTURAL INVESTIGATION OF SOME FACTORS IN PERSUASION AND ATTITUDE CHANGE; ONE- AND TWO-SIDED COMMUNICATIONS IN PERSUASION.
Technical rept. no. 5,
by Elliott McGinnies. Jun 64, 72p
Contract Nonr 3720 01, Proj. NR171 250
Unclassified report

Descriptors: (*Attitudes, Social communication), (*Public opinion, Foreign policy), Perception (Psychology), Verbal behavior, Cuba, Japan, Psychometrics, Culture.

The report is concerned with the relative effectiveness of one-sided versus two-sided presentations of an issue. Japanese University students were presented either with one-sided or two-sided communications on the subjects of the Cuban crisis and visits by American nuclear powered submarines to Japanese ports. In each instance, a point of view was taken favoring the official position adopted by the United States with regard to each of these issues. However, the research was designed to test the effects of including or omitting discussion of selected arguments opposing this position.

AD-604 569 Div. 28
OTS Prices: HC $2.00/MF $0.50

Institute for Psychological Research, Tufts Univ., Medford, Mass.
THE EFFECTS OF DISPLACED EARS ON AUDITORY LOCALIZATION.
Technical rept.,
by Sanford J. Freedman and Kenneth Stampfer.
Apr 64, 30p
Contract AF49 638 1282; Grant AF AFOSR53 63
AFOSR 64 0938
Unclassified report

Descriptors: (*Auditory perception, Psychoacoustics), (*Psychoacoustics, Auditory perception), Sound signals, Stabilization, Stimulation, Reaction (Psychology), Behavior, Auditory signals, Confinement (Psychology).

The techniques of rearrangement and disarrangement were used to alter the normal relationship between an observer and his auditory or visual environment. In general, rearrangement leads to orderly adaptation of perceptual-motor performance, while disarrangement leads to degradation of performance. This experiment was an auditory rearrangement. Subjects' judgments of auditory direction were displaced laterally by means of a high-fidelity pseudophone that effectively rotated the interaural axis through a 20 degree horizontal angle. After exposure sessions that consisted of walking repeatedly toward a fixed sound source for 20 minutes, two of the four experimental subjects demonstrated significant shifts averaging 6 degrees in their judgments of auditory direction. The shifts partially compensated for the error of localization produced by the pseudophone. The shifts in localization are discussed in terms of the nature of the exposure situation and the factors that are likely to be responsible for compensation. (Author)

AD-604 585 Div. 28
OTS Prices: HC $3.00/MF $0.75

Hebrew Univ., Jerusalem (Israel).
CORRELATES OF AMBIVALENCE, RISK-TAKING AND RIGIDITY.
Scientific rept. no. 1,
by A. Minkowich. 1 Jun 64, 70p
Grant AF EOAR63 62
AFOSR 64 1486
Unclassified report

Descriptors: (*Decision making, Personality), (*Behavior, Correlation techniques), (*Personality, Psychometrics), Attitudes, Perception (Psychology), Probability, Anxiety, Leadership, Group dynamics, Army personnel, Students, Israel.

An examination was made of the relationships of over 40 variables in 3 samples of subjects. The variables belonged to 5 classes: (1) Personality traits (ambivalence toward parents, siblings and authority figures, hostility toward the same figures, manifest anxiety, vacillation tendencies in risk taking and perception); (2) Socialization experiences (amount of parental reward and punishment experienced during childhood, frequency of psychological discipline and corporal punishment administered by each of the parents, strictness of religious upbringing); (3) Perceptual styles (field dependence, perceptual rigidity, intolerance of ambiguity); (4) Social attitudes and cognitive styles (authoritarianism, dogmatism); (5) Risk-taking behavior (playful risk, financial risk, physical risk, risk of prestige).

AD-604 604 Div. 28, 1, 19, 31
OTS Prices: HC $7.00/MF $1.50

Douglas Aircraft Co., Inc., Long Beach, Calif.
COMPLEX VEHICULAR CONTROLS.
ONR Symposium (2nd), May 62,
ed. by Alan A. Burrows and Jerry A. Emery.
1964, 324p
Unclassified report

Invited symposium held at the Royal Air Force Inst. of Aviation Medicine, Farnborough, Eng.

Descriptors: (*Control systems, Symposia), (*Human engineering, Control systems), Attitude control systems, Display systems, Vehicles, Aircraft, Helicopters, Submarines, Tracking, Performance (Human), Vision, Control, Operators (Personnel), Motor reactions.

A second ONR symposium was held in the field of complex vehicular controls. The fifteen papers and discussions presented cover the subject areas of man-machine systems, display systems, automatic and manual controls, handling qualities, vision problems, human equalization, environmental effects on the operator, tracking and serial choice tasks. Aircraft, helicopters and submarines were the primary vehicles treated. (Author)

AD-604 649 Div. 28, 18
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A 'TRANSITION MODEL' LABORATORY FOR RESEARCH ON CULTURAL CHANGE,
by John L. Kennedy. 8 Dec 55, 14p P-653, rev.
Unclassified report

Descriptors: (*Sociology, Simulation), (*Group dynamics, Test methods), (*Culture, Sociometrics), Behavior, Performance (Human), Stress (Psychology), Learning, Reaction (Psychology), Group dynamics, Military organizations, Social psychology, Adjustment (Psychology).

It may be possible to close the gap between field experiments on cultural change and traditional psychological laboratory investigations with laboratory studies of transition-model organizations analogous to the wind-tunnel studies of aircraft designers. Four such studies were conducted with an Air Defense Direction Center, using techniques that speeded up cultural change. Three periods of organizational growth--and several methods of cultural change--were observed in these model

28. Psychology and Human Engineering

AD-604 466 Div. 28
OTS Prices: HC $1.00/MF $0.50

Illinois Univ., Urbana.
EFFECTS OF VISUAL DISPLAY MODE ON SIX HOURS OF VISUAL MONITORING,
by Carl E. Webber and Jack A. Adams. Jun 64, 15p
Contract AF41 609 1481, Proj. 7751, Task 775104
SAM TDR64 34

Unclassified report

Descriptors: (*Attention, Performance tests), (*Psychomotor tests, Attention), Performance (Human), Visual acuity, Visual signals, Noise, Stimulation, Reaction (Psychology), Reflexes, Psychometrics, Analysis of variance.

An experiment was performed to assess the effects of visual display mode and six hours of monitoring on performance in a complex vigilance task. The task had 12 stimulus sources arrayed over 60 degrees, and numeric signals that persisted for 6 seconds. Each group of 15 subjects had a different display configuration: normally off, normally on, and normally on with visual noise. Display mode influenced overall mean performance, but not vigilance decrement. The amount of vigilance decrement was small despite the long session, and its magnitude was essentially the same as previous studies with sessions of two to three hours' duration. Findings supported earlier conclusions about the triviality of vigilance decrement when tasks are complex. (Author)

AD-604 471 Div. 28
OTS Prices: HC $1.00/MF $0.50

Hawaii Univ., Honolulu.
PREDICTIVE MODEL FOR INTRA-GROUP NEGOTIATION.
Final rept. for 1 Feb 62-31 Jun 64,
by Otomar J. Bartos. 31 Jun 64, 11p
Grant AF AFOSR62 314
AFOSR 64 1440

Unclassified report

Descriptors: (*Social communication, Mathematical models), (*Personality, Mathematical models), (*Group dynamics, Mathematical prediction), Probability, Verbal behavior, Social psychology, Behavior, Equations, Stochastic processes, Correlation techniques, Tests, Reaction (Psychology), Learning.

The study had the following objectives: (1) To test the assumption of maximization of expected utility. (2) To test the assumption that the impact of a speech depends only on which proposal it endorses. (3) To test the assumption that each negotiator speaks with a fixed probability. (4) To design a model that deals with negotiations in which majority (rather than unanimous) agreement is required. (5) To define optimal negotiation strategies. (6) To consider training expert negotiators. (Author)

AD-604 488 Div. 28
OTS Prices: HC $1.00/MF $0.50

Engineering Psychology Lab., Univ. of Michigan, Ann Arbor.
RESEARCH ON DECISION PROCESSES.
Final rept., 1 Apr 63-31 Mar 64,
by Ward Edwards. Jul 64, 15p IST-5569-1-F
Grant AF AFOSR 192 63
AFOSR 64 1439

Unclassified report

Descriptors: (*Decision making, Psychology), (*Bibliographies, Decision making), (*Abstracting, Decision making), Probability, Statistical analysis, Behavior.

The report consists of an annotated reference list concerning articles and speeches published, in press, or still in preparation on decision making. In the case of published articles, the annotation is the published summary or abstract of the article, with the addition of a few comments indicating its status in the research program. All articles and speeches resulting from the whole four-year research program are included; an attempt is made to identify the sources of support of each.

AD-604 513 Div. 28, 23, 26
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
HUMAN FACTORS ASPECTS IN MAINTAINABILITY,
by Nehemiah Jordan. Oct 61, 12p P-2459

Unclassified report

Descriptors: (*Human engineering, Maintenance equipment), (*Maintainability, Human engineering), (*Maintenance personnel, Training), Costs, Industrial equipment, Design, Handbooks, Maintenance, Performance tests.

The broad area of maintainability, as discussed by human factors scientists and engineers, is subdivided into three major interdependent sub-areas. They are: design for maintainability; training the maintenance man to be able to assume the responsibility for maintaining the equipment; and the tools, equipment and/or aids that are necessary to enable the maintenance man to meet his responsibilities.

AD-604 555 Div. 28
OTS Prices: HC $1.00/MF $0.50

Naval School of Aviation Medicine, Pensacola, Fla.
THE RELATIONSHIPS AMONG THE NEEDS AND VALUES OF FLIGHT CANDIDATES.
Rept. no. 39,
by Lawrence K. Waters. 16 Apr 64, 15p
Proj. MR005 13 3003

Unclassified report

Descriptors: (*Aviation personnel, Psychometrics), (*Students, Psychometrics), (*Psychometrics, Naval personnel), Adjustment (Psychology), Attitudes, Leadership.

The relationships among the scales of the Survey of Interpersonal Values and the Edwards Personal Preference Schedule were determined and compared to those reported for a college sample. Also, mean scale scores for flight candidates and college males were compared. Both within and between instrument scale correlations were similar to those obtained for college students. Several differences between flight candidate and college male mean scale scores were found. (Author)

AD-604 568 Div. 28
OTS Prices: HC $3.00/MF $0.75

Institute for Behavioral Research, Univ. of Maryland, College Park.

a low of 320,000 in 1953, but rose in 1954 owing to their use in training agricultural machinery operators on a large scale. The present Soviet policy appears to favor the continuance of these schools and the improvement in the quality of the training they offer through increasing the length of instruction. However, until the growth of the industrial labor force is slowed considerably, the majority of new workers will probably continue to be trained directly on the job. A great effort has been made since the war to improve the quality of the labor force through an elaborate system of courses, schools, and lectures. A common feature of these program is that they are conducted after working hours to prevent any interference with production. While the Soviet data are difficult to evaluate, one gains the impression that since 1945 a substantial majority of Russian industrial workers have been given technical training in the form of short lecture courses. (Author)

AD-604 986 Div. 28, 6
OTS Prices: HC $1.00/MF $0.50

Human Engineering Labs., Aberdeen Proving Ground, Md.
A PRELIMINARY COMPARISON OF RANGE ESTIMATION USING BLACK-AND-WHITE TELEVISION AND THE UNAIDED EYE,
by Lynn C. Oatman. Jan 63, 14p
HEL TN4 63

Unclassified report

Descriptors: (*Ranges (Distance), Determination), (*Monitors, Television equipment), (*Television equipment, Range finding), Visual perception, Errors, Targets, Optical images.

This investigation compared how accurately target ranges can be estimated from two modes of observation -- viewing a black-and-white television (TV) monitor, and viewing with the unaided eye. For each mode, the subjects made four estimates at each of five distances -- 100, 300, 600, 800, and 1000 yards. Two conclusions were indicated: (1) subjects could estimate absolute distance when viewing the TV monitor; and (2) there were significant differences between the subjects' constant errors in the two modes. (Author)

AD-604 987 Div. 28, 22
OTS Prices: HC $1.00/MF $0.50

Human Engineering Labs., Aberdeen Proving Ground, Md.
A COMPARISON OF TELESCOPIC-SIGHT ACCURACY AS A FUNCTION OF MAGNIFICATION AND TIME TO FIRE,
by R. Bradley Randall and William J. Faccidomo.
Apr 63, 22p
HEL TN7 63

Unclassified report

Descriptors: (*Telescopic gun sights, Effectiveness), Small arms, Targets, Visibility.

The investigation was designed to compare the accuracy of rifles equipped with telescopic sights of high (6x, 8x) and low (2.5x, 4x) powers of magnification, when targets were presented for both short (2 seconds) and long (8 seconds) time intervals. Twelve enlisted subjects fired a .22 caliber magnum semiautomatic rifle equipped with a 'BALvar-8' telescopic sight. When the measurements of marksmanship were analyzed, no significant difference were found between the various powers of magnification. Time-to-fire was a source of significant variation, with accuracy superior at the longer time interval. (Author)

AD-604 989 Div. 28
OTS Prices: HC $2.00/MF $0.50

Akron Univ., Ohio.
SOCIAL BACKGROUND AND THE PLAY OF GAMES,
Technical rept. no. 2,
by Norman F. Washburne, Cecil Darmofall, Tommy D. Johnson, and Alex O. Thio. 1964, 36p
Contract Nonr4302 00, Proj. NR177 356

Unclassified report

Descriptors: (*Decision making, Group dynamics), (*Social psychology, Decision making), Sociometrics, Psychometrics, Game theory, Performance tests, Behavior, Education, Reaction (Psychology), Males, Females, Students, Scientific personnel, Engineering personnel, Test methods, Correlation techniques.

To gain insight into differences in the ways task-oriented groups solve puzzles, take risks, and make strategic decisions, two- and three-person groups were observed playing puzzles, games of chance, and games of strategy. Data were gathered to indicate preferences and performance and used to test the hypotheses that male upper college students who major in science or engineering would tend to prefer and be better at puzzles; male upper college students who major in non-scientific fields will prefer and be better at games of chance and strategy, and that females who major in non-scientific fields will prefer and be better at games of strategy. The findings support the hypotheses concerning preference, and also show a slight relationship between preference and performance. They do not, however, support the predicted relationship between academic field and performance. (Author)

AD-604 991 Div. 28, 29
OTS Prices: HC $3.00/MF $0.75

Defense Subsistence and Supply Center, Chicago, Ill.
SOLDIERS' ATTITUDES TOWARD FOODS IN A TROPICAL ENVIRONMENT; PART 2, PILOT EXPERIMENT: METHODS FOR INDUCING FAVORABLE ATTITUDES TOWARD NOVEL AND FAMILIAR FOODS IN A TROPICAL ENVIRONMENT.
Interim rept.,
by John L. McCoy. Aug 63, 90p AMXFC-7-63
Proj. 7X95 01 001

Unclassified report

See also AD-413 789.

Descriptors: (*Military rations, Attitudes), (*Foods, Acceptability), Tropical regions, Environmental tests.

This is the 2nd part of a study of factors affecting soldiers' acceptance of QMC material, particularly of foods, in tropical environments. This report describes three methods for introducing unfamiliar and familiar foods in a jungle setting, and compares the relative effectiveness of each method in changing attitudes. (Author)

AD-605 009 Div. 28, 32
OTS Prices: HC $3.00/MF $0.75

RAND Corp., Santa Monica, Calif.
STALIN AND THE USES OF PSYCHOLOGY,
by R. C. Tucker. 1 Mar 56, 66p P-815

Unclassified report

Descriptors: (*Psychology, USSR), (*Conditioned reflex, Social psychology), Political science, Economics, Biology, Genetics, Ecology, Law, Social sciences, Behavior, Personality, Language.

organizations. The first, or 'basal' period, characterized by the use of individual, habitual ways of doing things, was followed by a 'consolidation' period characterized by the use of procedures borrowed from other groups and situations, by individual efforts and 'inventions,' and by blaming difficulties on faulty equipment. The last, or 'organization,' period was characterized by 'organizational inventions'--programs for coordinating individual behavior that lead, when successful, to new or modified institutions. Both the simulation techniques developed during transition-model laboratory studies and the indexes and other standards of measurement derived from them can be transferred directly for use in field studies. (Author)

AD-604 651 Div. 28, 16
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE EEG, CONSCIOUSNESS, AND SLEEP,
by Charles W. Simon and William H. Emmons.
15 Apr 55, 26p P-655
Unclassified report

Descriptors: (*Electroencephalography, Sleep), (*Sleep, Electroencephalography), Psychophysiology, Auditory signals, Learning, Recall, Stimulation, Reaction (Psychology), Males.

Monopolar occipital and vertex EEGs were taken from 21 normal, male, alpha-dominant adults during an 8-hour sleep. Information was presented by means of a tape recorder during this period. Subjects reported if they heard the information during stimulation and were later tested, upon rising, to see if they could recall it. These two variables were correlated with electroencephalographic patterns occurring during the information presentation. The following conclusions were drawn: (1) the probability of remembering and responding to meaningful auditory stimulation increased as the quantity and quality of waking alpha within the immediate vicinity increased; (2) the absence of alpha does not mean unconsciousness; (3) the presence of delta is an indication of unconciousness; unconciousness is directly related to delta amplitude and inversely related to delta frequency; (4) Several seconds of EEG scored by eye is a reliable measure of the state of conciousness; and (5) Awakening from sleep or the borderline of sleep as a result of auditory stimulation may lead to patterns showing special stimulus effects which fall along a consciousness continuum relative to the amount of alpha and delta within a pattern.

AD-604 866 Div. 28
OTS Prices: HC $3.00/MF $0.50

Institute of Environmental Psychophysiology, Univ. of Massachusetts, Amherst.
PERCEPTION AND SHORT TERM MEMORY UNDER WORK LOAD STRESS.
Technical rept.,
by Robert Seibel, Richard E. Christ, and Warren H. Teichner. 11 Jun 64, 52p
Contract N61339 1303
NAVTRADEVCEN 1303 2
Unclassified report

Descriptors: (*Computer operators, Stress (Psychology)), (*Perception (Psychology), Stress (Psychology)), (*Memory (Psychology), Stress (Psychology)), (*Stress (Psychology), Performance (Human)), Communication systems, Adjustment (Psychology), Input-output devices, Data storage systems, Systems engineering, Training, Visual perception, Recall, Human engineering, Data processing systems, Analysis of variance.

The primary purpose of these studies was to explore the question of whether a performance which is critically dependent upon short-term memory breaks down with input rate increases when performance is measured in absolute terms. Since, for any fixed input time, increases in quantity of information represent increases in the input rate, a breakdown, if demonstrated, can be thought of as the result of exceeding the memory storage rate. Thus, it could be asked, given such a breakdown, whether the absolute performance level might not be increased by reducing the informational input load. In simpler terms, will S report more correct items when there is less to be recalled than when there is too much to be recalled. The studies were set up with these questions in mind.

AD-604 919 Div. 28, 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE PSYCHOLOGIST IN INTERDISCIPLINARY RESEARCH,
by Harry H. Harman. 25 Jul 55, 10p P-708
Unclassified report

A symposium of the APA Convention; San Francisco, Calif., 5 Sep 55.

Descriptors: (*Scientific organizations, Psychology), (*Psychology, Scientific organizations), (*Scientific research, Psychology), Scientific personnel, Professional personnel, Group dynamics, Operations research, Air defense command, Training, Models (Simulations), Personality, Behavior.

An analysis of the development of inderdisciplinary research programs and the role of the psychologist in such programs is presented. A training program for the psychologist engaged in interdisciplinary activities is suggested.

AD-604 920 Div. 28, 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
SOME OBSERVATIONS ON FACTOR ANALYSIS,
by Harry H. Harman. 27 Jul 55, 10p P-710
Unclassified report

Presented at The Biometric Society Session on Psychometrics, California Inst. of Tech., 23 Jun 55.

Descriptors: (*Factor analysis, Psychometrics), (*Psychometrics, Factor analysis), Theory.

This paper is concerned with the origin and growth of factor analysis. An appraisal is made of its present status. The paper, therefore, is non-mathematical, expository in character.

AD-604 938 Div. 28
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
INDUSTRIAL TRAINING IN THE SOVIET UNION,
by Walter Galenson. 31 Aug 55, 46p P-729
Unclassified report

Descriptors: (*Industrial training, USSR), Labor, Education, Personnel.

The State Labor Reserves schools reached their peak in 1948, when they graduated one million workers. During the same year, 2.3 million new workers were trained on the job. The output of the Labor Reserves schools fell gradually to

29. Quartermaster Equipment and Supplies

AD-604 737 Div. 29, 12, 16
OTS Prices: HC $1.75/MF $0.75

Army Natick Labs., Mass.
DEVELOPMENT OF FOOD ITEMS TO MEET AIR FORCE REQUIREMENTS FOR SPACE TRAVEL,
by Herbert A. Hollender. Jun 64, 88p
Contract AF33 616 61 18, Proj. 7164, Tasks 716405, 40491
AMRL TDR64 38

Unclassified report

Descriptors: (*Food, Astronauts), (*Closed ecological systems, Food), Nutrition, Storage, Temperature, Freeze drying, Containers, Algae, Meat, Frozen foods, Fruits, Taste, Colors, Dehydrated foods, Alkaloids, Culture media, Space biology, Space environmental conditions, Life support.

Prototype foods to meet the requirements of space travelers were investigated. These foods were required to be lightweight, easy to prepare, highly nutritious, neither thirst provoking nor gas forming, and low in crude fiber. The food should not exceed a cube size of 1/4 - 3/8 inch and should, after storage up to 6 months at 40, 70, and 100F, closely resemble the color, flavor, and texture of fresh food. All foods were rated on a 9.0 Hedonic scale. Foods served to a panel at the Armed Forces Food and Container Institute were considered acceptable when they rated 6.0 or above. Freeze-dehydrated foods were investigated. Certain tubed foods were studied to determine whether they were acceptable after storage up to 15 months at 40, 70, and 100F. Many tubes showed internal swelling. Peaches, apricots, beef and vegetables, and beef and gravy in tubes with Sunex 11-S lining were found to be acceptable in both texture and taste. Studies of Chlorella 71105 were made to modify the flavor, taste, and color and to enhance the nutritive values. Two strong objections to the use of this algae were its dark green color and its bitter gagging aftertaste. Three processes were developed to remove the bitter taste of the algae. However, further studies should be completed to identify the bitter taste. (Author)

Certain Soviet ideological trends of recent years are discussed in their relation to the regime's policy in internal affairs. These trends center around the militant revival in Soviet psychology of Pavlov's teachings on the conditioned reflex. The Pavlovian revival, which began in 1949, is examined in connection with various developments in biology, political economy, and other fields, and the entire ideological complex is related to a central policy motivation which is called 'transformism.' The final part of the study is concerned with various indications of a post-Stalin retreat from transformism and the ideology associated with it.

AD-605 106 Div. 28, 26
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.

A DISPLAY TECHNIQUE FOR PLANNING,
by John L. Kennedy. 23 Oct 56, 12p P-965
Unclassified report

Descriptors: (*Management planning, Display systems), (*Applied psychology, Display systems), Human engineering, Management engineering, Motivation, Group dynamics, Personnel.

This paper describes a display technique which can be developed and used by teams of planners and decision-makers when faced with the complexities of planning and developing large interacting systems. In particular, it is proposed that the contextual map will substantially assist decision-making in Air Force research and development, where decisions now have critical consequences for national security.

Descriptors: (*Analog-to-digital converters, Design), Pulse generators, Computer logic, Diodes, Test equipment (Electronics), Analog computers, Electrical networks, Synthesis.

The basic conversion problems are introduced and methods of solving these problems suggested. The topics selected for study are: picosecond pulse generation, gigabit logic circuits, and quantization circuits which are fundamental to the needs of most conversion systems. The component parts of the system are discussed in conjunction with performance calculations and a sound circuit approach is recommended. A generalized diode model is developed which is then simulated on the analog computer. Comparisons are given between computer solutions and experimental results. Transient response solutions of picosecond pulse generator circuits are obtained on the analog computer by using the diode model for all diodes in the network. The design of a triplate tester is given with experimental results from a sampling oscilloscope which show good correlation with the analytical results. Then, two one-gigabit shift register circuit arrangements are synthesized on the analog computer and solutions for network variables given. Finally, the design of a triplate tester is discussed and the test results showing good operational margins at a one-gigabit rate are given.

AD-604 531 Div. 30
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
99-GATE,
by Theodore A. Van Wormer. Aug 62, 49p P-2602
Unclassified report

Descriptors: (*Programming languages, Computers), (*Programming (Computers), Programming languages).

The paper is a primer for instruction in the 99-GATE language. 99-GATE is a system in which you may instruct a computer to perform algebraic computations. Specifically, 99-GATE is: General Algebraic Translator Extended for the IBM 709/7090.

AD-604 540 Div. 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
CONTROL AND SUPPORT SYSTEMS: SUMMARY AND RECOMMENDATIONS,
by J. D. Williams. 24 Nov 59, 11p B-156-1
Unclassified report

Descriptors: (*Control systems, Air Force research), (*Research program administration, Control systems), Scientific research, Personnel, Economics, Automata, Systems engineering.

The importance and necessity of sponsoring and pushing basic research are examined in light of development hierarchies, economic, and personnel considerations.

AD-604 541 Div. 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
CONTROL AND SUPPORT SYSTEMS: INTRODUCTION,
by J. D. Williams. 24 Nov 59, 7p B-144-1
Unclassified report

Descriptors: (*Command and control systems, Air force research), (*Control systems, Air force research), National defense, Computers, Strategic Air Command, Systems engineering.

The command, control, and support systems of the Air Force are discussed.

AD-604 542 Div. 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
CONTROL AND SUPPORT SYSTEMS: BASIC RESEARCH FOR THE MAN-MACHINE COMMUNICATION BARRIER,
by Willis H. Ware. 25 Nov 59, 12p B-147-1
Unclassified report

Descriptors: (*Digital computers, Scientific research), (*Control systems, Scientific research), Simulation, Humans, Game theory, Communication systems.

The paper discusses the importance of basic research towards the development of computers which simulate human intelligence.

AD-604 543 Div. 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
CONTROL AND SUPPORT SYSTEMS: THEIR DESIGN AND DEVELOPMENTS,
by C. J. Zwick. Rev. 30 Nov 59, 13p B-146-1
Unclassified report

Descriptors: (*Control systems, Air Force research), Feedback, Decision making, Communication systems, Data processing systems, Logistics, Simulation.

The discussion covers two subjects. It comments on some of the problems the Air Force is currently encountering in designing control systems. Secondly, it outlines an approach to control-system development that has been taken in the simulation laboratory.

AD-604 571 Div. 30, 18
OTS Prices: HC $6.00/MF $1.25

Sylvania Electronic Systems, Needham, Mass.
MILDATA STUDY; A FEASIBILITY STUDY OF FUTURE MILITARIZED DIGITAL COMPUTER REQUIREMENTS.
Quarterly progress rept. no. 3 for period ending 30 Apr 64,
by E. cohler, W. Dunnet, K. Foster, R. Lechner, and A. rosene. 30 Apr 64, 263p
Contract DA36 039AMC03276E
Unclassified report

AD-600 284

Descriptors: (*Digital computers, Military requirements), (*Data processing systems, Digital computers), Modules (Electronic), Feasibility studies, Design.

The major areas of this report are system organization concepts, memory subsystems, unit record equipment, digital circuitry, processor design methodology, and interface design objectives. Three appendices discuss block design generation and research now under way on dynamic allocation procedures and speech recognition. Two proprietary appendices with limited distribution discuss possible improvements on permanently recorded delay line memories and processor organization concepts. (Author)

30. Research and Research Equipment

AD-604 331 Div. 30, 25
OTS Prices: HC $1.00/MF $0.50

Redstone Scientific Information Center, Redstone Arsenal, ALA.
THE NEW PHOTOELASTIC APPARATUS AT THE MECHANICAL TECHNICAL LABORATORY OF THE MUNICH ADVANCED TECHNICAL SCHOOL,
by L. Foppl and R. Hiltscher. 24 Jul 64, 7p
RSIC 232; TT 64 71234
Unclassified report

Trans. of der Bauingenieur (Germany) 1939, v. 20, no. 17/18, p. 231-232.

Descriptors: (*Photoelasticity, Optical analysis), (*Optical instruments, Photoelasticity), Stresses, Materials, Optical properties, Measurement, Optical equipment components, Design, Operation, Physics laboratories, West Germany.

An optical stress apparatus, consisting of lamp housing, frosted glass plate, filter polarizers, quarter wave plates, and camera is discussed.

AD-604 350 Div. 30, 23
OTS Prices: HC $3.00/MF $0.50

Parke Mathematical Labs., Inc., Carlisle, Mass.
MADCAP: MAMMOTH DECIMAL ARITHMETIC PROGRAM FOR THE PDP-1 COMPUTER.
Scientific rept. no. 1,
by E. Myrvaagnes. Jun 64, 54p
Contract AF19 628 3826, Proj. 5628, Task 562801
AFCRL 64 510
Unclassified report

Descriptors: (*Programming languages, Mathematics), (*Compilers, Programming languages), (*Digital computers, Programming languages), Computers, Control sequences, Programming (Computers), Instruction manuals.

A multiple-precision floating-point arithmetic program, MADCAP, for the PDP-1 Computer is described. The number of significant digits maintained during calculations can be varied easily to suit the user's requirements of speed vs. accuracy. Programming in MADCAP's own source language is extremely simple. (Author)

AD-604 364 Div. 30, 23
OTS Prices: HC $3.00/MF $0.75

RAND Corp., Santa Monica, Calif.
BEGINNER'S FORTRAN,
by A. Sweetland. Oct 61, 71p P-2457
Unclassified report

Descriptors: (*Programming languages, Algebra), (*Compilers, Programming languages), Control sequences, Programming (Computers), Instruction manuals, Computers.

Simple mathematical problems are used to illustrate page format. Flow diagrams and the logic of testing are covered. Inputs, Outputs and card layouts are also explained.

AD-604 370 Div. 30, 15
OTS Prices: HC $1.00/MF $0.50

California Univ., Los Angeles.
A PROBLEM IN PATTERN RECOGNITION,
by Zivia S. Wurtele. Jun 64, 12p WMSI-WP-48
Contract Nonr233 75, Projs. NR047 041, NR047 003
Unclassified report

Work partly supported by a grant from the Ford Foundation.

Descriptors: (*Pattern recognition, Mathematical analysis), (*Artificial intelligence, Mathematical analysis), Learning, Stochastic processes, Numerical methods and procedures, Algebra.

Independent observations, made simultaneously on members of each of two categories, are presented to an artificial intelligence. It is assumed that the space of the attribute or observation vectors of the individuals to be classified is a finite dimensional Euclidean space, and that the attribute vectors are strictly separable by a hyperplane. When the artificial intelligence is presented with a pair of vectors, it is informed of the categories to which these vectors belong; it then estimates a separating hyperplane. This paper describes an algorithm for making this estimate and gives conditions for the convergence of this estimate to a hyperplane which correctly separates the regions. In general, this type of learning problem may be solved by any of a large class of algorithms which differ in their convergence rates, complexity of computation and amount of memory. It is hoped that the relatively simple convergence proof for the algorithm of this paper will provide some insight into the more general problem.

AD-604 388 Div. 30, 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ON THE 'BANG-BANG' CONTROL PROBLEM,
by Richard Bellman, Irving Glicksberg, and Oliver Gross. Rev. 2 Mar 55, 21p P-552
Unclassified report

Descriptors: (*Control systems, Mathematical analysis), Calculus of variations, Mapping (Transformations), Convex sets, Topology, Functional analysis.

Let S be a physical system whose state at any time is described by an n-dimensional vector x(t), where x(t) is determined by a linear differential equation Z = Az, with A a constant matrix. Application of external influences will yield an inhomogeneous equation, Z = Az + f, where f, the 'forcing term', represents the control. A problem of some importance in the theory of control circuits is that of choosing f so as to reduce z to 0 in minimum time. If f is restricted to belong to the class of vectors whose i(th) components can assume only the values ±b sub i, the control is said to be of the 'bang-bang' type. The case where all the solutions of Z = Az approach zero as t approaches infinity is considered.

AD-604 421 Div. 30, 8
OTS Prices: HC $6.00/MF $1.50

Martin Marietta Corp., Baltimore, Md.
RESEARCH FOR HIGH SPEED ANALOG-TO-DIGITAL CONVERSION TECHNIQUES.
Rept. for 15 Jun 63-15 May 64,
by Brian E. Sear. Aug 64, 296p
Contract AF33 657 11370, Proj. 4335, Task 433521
AL TDR64 154
Unclassified report

device weighing several tons. Some machines may perform 10,000 operations per second; others, only a few hundred. In common, however, they all exhibit when compared to a competing system staffed by people, a phenomenal record for freedom from error plus some measure of increased rate of production. The paper presents a short background of this new field of electronic computing machinery and briefly examines the characteristics of the modern machine, its applications, the difficulties of using it, and the limitations imposed on it by the present state of the electronic art. A forecast of probable future trends in application is given, together with a discussion of the expected advances in the technique and physical hardware and in the logical organization of such machines. (Author)

AD-604 645 Div. 30, 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE APPLICATION OF STATISTICAL METHODS TO THE DESIGN AND ANALYSIS OF EXPERIMENTS,
by D. S. Stoller. 22 Mar 55, 12p P-646
Unclassified report

Presented at American Ordnance Association's 1955 Symposium on Proving Ground Instrumentation at Patrick AFB, Fla., 14-15 Apr 55.

Descriptors: (*Tests, Statistical analysis), Environmental tests, Test methods, Performance (Engineering), Analysis, Design.

The paper provides a general survey of some topics in statistics and operations research applicable to experimental design and analysis. It is based on the premise that how to measure and what to measure are simultaneous considerations in a test program. Furthermore, in order to verify that a test setup measures what it is supposed to measure it is necessary to design an experiment to this end and analyze the results. Three general topics in the design and analysis of experiments are: test criteria, test designs, and test analyses.

AD-604 656 Div. 30, 8, 24
OTS Prices: HC $1.00/MF$0.50

Electro-Dynamics Labs., Utah State Univ., Logan.
RECOGNIZING PATTERNS IN PHOTOGRAPHS.
Scientific rept. no. 1,
by C. K. Rushforth. 1 May 64, 19p
Contract AF19 628 3825, Proj. 8663
AFCRL 64 640
Unclassified report

Descriptors: (*Pattern recognition, Photographs), Photographic images, Optical images, Communication theory, Signals, Artificial intelligence, Signal-to-noise ratio, Decision theory.

The problem of recognizing patterns in photographs is considered. It is assumed that the patterns to be classified are exactly known, and that the photograph is sampled and quantized to form a binary vector. The optimum classification procedure for the general case involves nonlinear data processing on this vector. In two important special cases, however, this optimum procedure reduces to one which uses correlation or matched-filter techniques. The analysis applies not only to the specific problem described here, but to any situation in which the patterns to be classified may be represented by binary vectors provided the appropriate assumptions are satisfied. An important example is the so-called property-list description of a pattern. (Author)

AD-604 671 Div. 30
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
INTRODUCTION TO ELECTRONIC COMPUTERS. CHAPTER 1 . INTERPRETIVE ROUTINES,
by F. J. Gruenberger and D. D. McCracken.
Feb 62, 27p P-2529
Unclassified report

Descriptors: (*Computers, Textbooks), Compilers, Control sequences, Mathematics, Data processing systems, Digital computers, Programming (Computers).

The use of an interpretive coding scheme in the mechanical handling of a group of subroutines involving simple arithmetic operations are examined.

AD-604 678 Div. 30
OTS Prices: HC $2.00/MF $0.50

Massachusetts Inst. of Tech., Cambridge.
VERBAL AND GRAPHICAL LANGUAGE FOR THE AED SYSTEM: A PROGRESS REPORT,
by Douglas T. Ross and Clarence G. Feldmann.
6 May 64, 29p MAC-TR-4
Contracts Nonr4102 01, AF33 600 42859
Unclassified report

Rept. on Project MAC.

Descriptors: (*Programming languages, Data processing systems), (*Programming (Computers), Design), Compilers, Computers, Computer personnel, Programmers.

For Computer-Aided Design use of time-sharing a single language which can take either verbal or graphical form is required. The paper describes how a single language processing technique, which is in turn a special application of more general concepts concerning the step-by-step growth and processing of large structures of interrelated elements, can efficiently process both language forms in the same manner. Illustrations of the concepts involved are also drawn from the methods used in the AED-0 compiler, an efficient ALGOL-60-based compiler used in Computer-Aided Design work, which is available as a public command in the Project MAC CTSS. (Author)

AD-604 679 Div. 30, 13
OTS Prices: HC $1.00/MF $0.50

Massachusetts Inst. of Tech., Cambridge.
STRESS: A PROBLEM-ORIENTED LANGUAGE FOR STRUCTURAL ENGINEERING,
by John M. Biggs and Robert D. Logcher.
6 May 64, 23p MAC-TR-6
Unclassified report

Rept. on Project MAC.

Descriptors: (*Programming languages, Data processing systems), (*Structures, Mathematical analysis), Construction, Stresses, Loading (Mechanics), Engineering, Digital computers.

STRESS is a general purpose programming system for the analysis of structures. Compared to most other structural programs it has three distinguishing characteristics: (1) The input language is that of the structural engineer which makes possible direct communication between the engineer and the machine; (2) The system is capable of analyzing a wide variety of structural types and loading conditions thus permitting industrial use on a routine basis; and (3) The design process is expedited

AD-604 587 Div. 30, 15
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
INTRODUCTION TO ELECTRONIC COMPUTERS. CHAPTER 8: USING THE RANDOM NUMBER GENERATOR,
by F. D. Gruenberger and D. D. McCracken.
Dec 61, 27p P-2490

Unclassified report

Descriptors: (*Computers, Textbooks), Probability, Mathematics, Cryptography, Operation, Numerical methods and procedures, Statistical functions, Compilers, Data processing systems, Programming (Computers), Instruction manuals.

A number of problems or games involving random number generators are discussed.

AD-604 590 Div. 30, 8, 25
OTS Prices: HC $1.00/MF $0.50

Lincoln Lab., Mass. Inst. of Tech., Lexington.
DIVISION 2. DATA SYSTEMS.
Quarterly progress rept. for 1 May-31 Jul 64,
by F. C. Frick and S. H. Dodd. 15 Aug 64, 23p
Contract AF19 628 500
ESD TDR64 358

Unclassified report

Descriptors: (*Computers, Reports), (*Data storage systems, Electronics), Digital computers, Circuits, Integrated circuits, Magnetic tape, Thin films (Storage devices), Metal films, Tunneling (Electronics), Communication theory, Analog-digital computers, Information retrieval, Programming (Computers), Computer storage devices, Semiconductor devices.

Contents:
Digital Computers, (Computer Systems, Circuit Development, Magnetic Film Engineering, System Programming and Application) Computer Components, (Magnetic Films, Electron Transport, Film-Memory Sense Amplifier) Psychology, (Automatic Procedure Executor (APEX), Human Information Processes, Man-Machine Communication) Control Research, (On-Line Use of Hybrid Computers, Data Storage and Retrieval).

AD-604 591 Div. 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
INTRODUCTION TO ELECTRONIC COMPUTERS, APPENDIX 1,
by F. J. Gruenberger and D. D. McCracken.
Dec 61, 6p P-2504

Unclassified report

Descriptors: (*Computers, Textbooks), Integrals, Algebra, Equations, Numerical methods and Procedures, Compilers, Data processing systems, Programming (Computers), Instruction manuals.

A problem in Diophantine equations (one equation with two unknowns) is examined.

AD-604 592 Div. 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
INTRODUCTION TO ELECTRONIC COMPUTERS, APPENDIX 3,
by F. J. Gruenberger and D. D. McCracken.
Dec 61, 8p P-2505

Unclassified report

Descriptors: (*Computers, Textbooks), Control sequences, Search theory, Data storage systems, Operation, Compilers, Data processing systems, Programming (Computers), Instruction manuals.

The common situation of incorrectly modified addresses for storage searches and the value of a search routine are discussed.

AD-604 593 Div. 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
INTRODUCTION TO ELECTRONIC COMPUTERS, APPENDIX 4,
by F. J. Gruenberger and D. D. McCracken. Dec 61, 5p P-2506

Unclassified report

Descriptors: (*Computers, Textbooks), Records, Students, Operation, Data storage systems, Numbers, Data processing systems, Compilers, Programming (Computers), Instruction manuals.

A bookkeeping routine is suggested where the computer maintains a grade book for the student class.

AD-604 598 Div. 30, 18
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
COMMAND AND SUPPORT SYSTEMS: PROBLEMS AND CAPABILITIES,
by W. M. Jones. 11 Nov 59, rev. 20 Jan 60, 9p
B-145-1

Unclassified report

Descriptors: (*Control systems, Air Force research), (*Programming (Computers), Command and control systems), (*Command and control systems, Strategic air command), Digital computers, Air Force operations, Deployment, Systems engineering, Compilers.

The work done and the types of problems faced in four computer routines which are applicable to command and control systems are described. The routines involve the planning functions of the Stategic Air Command.

AD-604 621 Div. 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE DIGITAL COMPUTER, WHERE DOES IT GO FROM HERE,
by Willis H. Ware. 5 Oct 54, 19p P-608

Unclassified report

Presented before the Los Angeles Section of The Institute of Radio Engineers.

Descriptors: (*Digital computers, Data processing systems), Operation, Design, Electronic equipment, Automation.

The modern digital computing system can range from a 100 tube device the size of a desk to a many thousand tube

Descriptors: (*Compilers, Data storage systems), (*Data storage systems, Compilers), Programming languages, Coding, Digital computers, Computer storage devices, Data transmission systems.

The function of PACT is to compile a machine-language code from a given PACT pseudo-language code. In this sense PACT shortens the gap between the computational model and the final machine code by performing much of the intervening work. The paper is primarily concerned with the system which was designed to allocate machine storage locations for the operands which are involved in PACT pseudo-operations. The system was made to allocate storage locations automatically up to the total capacity of the high-speed memory and to allow the user some convenient means for constraining this allocation when necessary. No provision was made for automatic secondary storage allocation.

AD-604 730 Div. 30, 15
OTS Prices: HC $5.00/MF $1.00

Massachusetts Inst. of Tech., Cambridge.
NATURAL LANGUAGE INPUT FOR A COMPUTER PROBLEM SOLVING SYSTEM.
Doctoral thesis,
by Daniel G. Bobrow. Sep 64, 155p MAC-TR-1
Contract Nonr4102 01
Unclassified report

Rept. on Proj. MAC.

Descriptors: (*Programming languages, Data processing systems), (*Programming (Computers), Language), Communication theory, Algebra, Simultaneous equations, Mathematical programming, Artificial intelligence, Transformations (Mathematics), Numerical analysis.

The STUDENT problem solving system, programmed in LISP, accepts as input a comfortable but restricted subset of English which can express a wide variety of algebra story problems. STUDENT finds the solution to a large class of these problems. The thesis includes a summary of other English language question-answering systems. The linguistic analysis in STUDENT is a first approximation to the analytic portion of a semantic theory of discourse outlined in the thesis. STUDENT finds the set of kernel sentences which are the base of the input discourse, and transforms this sequence of kernel sentences into a set of simultaneous equations which form the semantic base of the STUDENT system. STUDENT then tries to solve this set of equations for the values of requested unknowns. If it is successful it gives the answers in English. If not, STUDENT asks the user for more information, and indicates the nature of the desired information. The STUDENT system is a first step toward natural language communication with computers. (Author)

AD-604 793 Div. 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
SCHEDULING STATE OF THE ART, ANATHEMA OR NECESSITY,
by F. S. Pardee. Nov 61, 14p P-2511
Unclassified report

Descriptors: (*Scheduling, Research program administration), (*Research program administration, Scheduling), Operations research, Management planning, Management control systems, Analysis, Reviews.

This paper explores the meaning of statements concerning the rate of technological advancement and particularly their implications for R and D planning.

AD-604 795 Div. 30
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
INTRODUCTION TO ELECTRONIC COMPUTERS, CHAPTER 6. SUBROUTINING,
by F. J. Gruenberger and D. D. McCracken.
Nov 61, 30p P-2481
Unclassified report

Descriptors: (*Computers, Textbooks), Compilers, Digital computers, Programming (Computers), Control sequences, Programmers, Mathematics, Data processing systems.

Subroutining, the use of a given set of instructions repeatedly that are executed on demand from other instructions, is described.

AD-604 796 Div. 30
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
INTRODUCTION TO ELECTRONIC COMPUTERS. CHAPTER 7. RANDOM NUMBERS,
by F. J. Gruenberger and D. D. McCracken.
Nov 61, 32p P-2475
Unclassified report

Descriptors: (*Computers, Textbooks), Numbers, Probability, Mathematical logic, Compilers, Digital computers, Programming (Computers), Data processing systems.

Random number generation and computer routines are discussed.

AD-604 804 Div. 30, 26
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A SYSTEMS ENGINEERING APPROACH TO RELIABILITY,
by Alexander W. Boldyreff. Nov 61, 12p P-2476
Unclassified report

Descriptors: (*Systems engineering, Reliability), (*Reliability, Systems engineering), Theory, Malfunctions, Redundant components, Operations research.

The main theme of the paper is that reliability must be sought as an integral of the over-all system design. A listing of what should be the principal areas of concern to a reliability engineering organization is presented. Also, a short list of some general methods of increasing system reliability which is believed to be basic in designing for reliability is given.

AD-604 815 Div. 30, 9
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE PREPARATION OF CAMPHOR MODELS FOR WIND-TUNNEL SUBLIMATION STUDIES; PRELIMINARY RESULTS ON THE SUBLIMATION OF A POINTED CONE,
by Andrew F. Charwat. Jul 62, 28p P-2611
Unclassified report

by the fact that modifications of the original structure for alternate designs can be easily executed. This last capability is most effectice when STRESS is used in the time-sharing mode. These features combine to provide a system which not only reduces the effort required for structural analysis but, more significantly, enhances the designer's ability to evolve an efficient structure. (Author)

AD-604 680 Div. 30
OTS Prices: HC $1.00/MF $0.50

Massachusetts Inst. of Tech., Cambridge.
OPL-I: AN OPEN ENDED PROGRAMMING SYSTEM WITH CTSS,
by J. Weizenbaum. 30 Apr 64, 13p MAC-TR-7
Contract Nonr4102 01
Unclassified report

Rept. on Project MAC.

Descriptors: (*Programming languages, Data processing systems), (*Programming (Computers), Effectiveness), Data storage systems, Decision theory, Operators (Mathematics), Topology, Computer storage devices, Computer personnel.

OPL-I, an incremental programming system presently operating with CTSS, permits the user to augment both his program and his data base during widely separated successive sessions at his terminal. Facilities are provided which make it possible for the user to operate on his already established data base both by means of built-in operators and in terms of operators (functions) which the user has previously defined in the language of the system. Underlying the system is a powerful list processing scheme imbedded in FORTRAN (SLIP). The machinery of this fundamental language drives the system and is also largely available to the user. The data base generated by the user is therefore a set of list structures (trees), and most of the operators available to him are list processing operators. Data structures with considerably complex interrelational properties may therefore be treated quite directly. (Author)

AD-604 681 Div. 30
OTS Prices: HC $3.00/MF $0.75

Massachusetts Inst. of Tech., Cambridge.
THE OPS-1 MANUAL,
by Martin Greenberger. May 64, 66p MAC-TR-8
Contract Nonr4102 01
Unclassified report

Rept. on Project MAC. Prepared in cooperation with the M. I. T. 15.599 Seminar.

Descriptors: (*Programming languages, Data processing systems), (*Programming (Computers), Design), Operators (Mathematics), Computers, Symposia.

The recent attainment and continuing development of personally accessible computer facilities have opened another chapter in the use of machines by man. A number of current research efforts, including Project MAC at M.I.T., are designing new conceptual systems to adapt the emerging technology to a wide range of human activity. Activities relating to management are the concern of a trial system at Project MAC called OPS-1. The OPS-1 system and the experiment that launched it are described in the manual. (Author)

AD-604 695 Div. 30, 26, 28
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE SYSTEMS RESEARCH LABORATORY AND ITS PROGRAM,
by John L. Kennedy. Rev. 17 Oct 55, 4p P-657
Unclassified report

Descriptors: (*Systems engineering, Research program administration), Industrial relations, Group dynamics, Production control, Management engineering, Simulation, Operations research.

A systems research laboratory, whose primary interest has been the behavior of man-machine systems, was established. The goal of the laboratory, predicting the performance of man-machine systems, is discussed.

AD-604 715 Div. 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A DESCRIPTION OF A COOPERATIVE VENTURE IN THE PRODUCTION OF AN AUTOMATIC CODING SYSTEM,
by Wesley S. Melahn. 27 Sep 55, 11p P-686
Unclassified report

Descriptors: (*Programming (Computers), Automatic), (*Programming languages, Design), Computer personnel, Symposia.

The paper surveys and evaluates some of the ideas that were suggested during a search for an improved way of programming problems for machine solution. It attempts to justify the choices that were made in the design of PACT I, a program that produces efficient machine language code for the 701 computer from a concise description of the steps in a calculation. (Author)

AD-604 721 Div. 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
PACT LOOP EXPANSION,
by Gus Hempstead and Jules I. Schwartz. 31 Oct 55, 16p P-692
Unclassified report

Descriptors: (*Compilers, Control sequences), Computers, Feedback, Programming (Computers), Operation, Data storage systems.

A discussion of the method used to write loops in machine language for any series of PACT I compiler instructions is presented. (Author)

AD-604 722 Div. 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
SEMI-AUTOMATIC ALLOCATION OF DATA STORAGE FOR PACT I,
by J. I. Derr and R. C. Luke. 10 Oct 55, 18p P-693
Unclassified report

Prepared in cooperation with Lockheed Aircraft Corp.

sis, Groups (Mathematics), Topology, Numbers, Functions, Switching circuits.

The report presents the results of several related investigations of computer logic and number systems. The report is divided into seven parts, which deal with group equivalence of switching functions, group methods in switching theory, multilevel Boolean minimization, minimal synthesis of tree structures, three-valued logical systems, and the general properties of finite, weighted number systems. (Author)

AD-604 861 Div. 30, 16
OTS Prices: HC $0.50/MF $0.50

Dayton Univ., Ohio. Research Inst.
AN AUTOMATIC LOGGING SYSTEM FOR BIOMEDICAL TEST DATA,
by William J. Hovey, Jesse E. Gilmore, and Abbot T. Kissen. Jun 64, 26p
Contract AF33 657 8521, Proj. 7164, Task 716409
AMRL TDR64 50

Unclassified report

Descriptors: (*Data processing systems, Medical research), (*Medical research, Data processing systems), Digital computers, Programming (Computers), Instrumentation, Input-output devices, Control systems, Heat tolerance, Space medicine.

An automatic data acquisition system was designed to minimize the data reduction of biomedical test data. The overall system consists of two main parts; a hardware group, which digitizes and records the raw data, and a computer program, which reduces the data and presents it in tabular form for ready analysis. The system is capable of simultaneously recording up to 27 thermocouple, 27 thermistor, and 24 miscellaneous data channels during any given experiment. The sampling speed is such that it takes approximately 6 seconds to record all 78 channels. Major design considerations were ease of use, utility, flexibility, and reliability. All scale factors and calibrations, both linear and nonlinear, will be effected by the computer program; the recording hardware only digitizes and records voltage levels. (Author)

AD-604 862 Div. 30
OTS Prices: HC $2.00/MF $0.50

General Electric Co., Washington, D. C.
APPLICATIONS OF SERIAL AND PARALLEL FILE STRUCTURES TO COMMAND AND CONTROL SYSTEMS,
by Stanley B. Rosen, John P. McCabe, and Essie S. Nevans. Aug 64, 46p
Contract AF19 628 3843, Proj. 2801, Task 280101
ESD TDR64 519

Unclassified report

Descriptors: (*Command and control systems, Data storage systems), (*Data storage systems, Command and control systems), Magnetic tape, Disk recording systems, Computer storage devices, Time studies, Numbers, Digital computers, Mathematical analysis.

This study was undertaken to determine if the introduction of redundant files can reduce search time when serial outputs are required. Serial and parallel file structures on magnetic tape and disc memories were studied. The conclusion was made that search time can be improved because of the inherent random-access features of disc memory. Further studies relevant to the study are suggested. (Author)

AD-604 907 Div. 30
OTS Prices: HC $5.00/MF $1.00

Office of Aerospace Research, Washington, D. C.
UNITED STATES AIR FORCE RESEARCH ACCOMPLISHMENTS,
Jun 64, 156p
OAR 64 6

Unclassified report

Descriptors: (*Air Force research, Reviews), Physics, Chemistry, Mathematics, Electronics, Materials, Energy conversion, Geophysics, Atmosphere, Astronomy, Biology, Medicine, Psychology, Social sciences.

Summaries are given of the results of 130 selected research projects in the physical, engineering, environmental, and life sciences.

AD-604 921 Div. 30, 15, 32
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ON THE SOLUTION OF DISCRETE PROGRAMMING PROBLEMS,
by Harry M. Markowitz and Alan S. Manne.
1 Aug 55, rev. 9 Feb 56, 46p P-711

Unclassified report

Descriptors: (*Linear programming, Optimization), Convex sets, Calculus of variations, Model theory, Operations research, Economics, Industrial production, Transportation, Mathematical programming.

This paper considers optimization problems in which some or all variables must take on integral values. An ability to solve such problems would be valuable in itself and would also allow handling certain kinds of heretofore intractable 'economies of scale'. An automatic algorithm for solving such problems is not given. A general approach susceptible of individual variations, depending upon the problem and the judgment of the user is presented. Two moderate-size examples are presented to illustrate the method. (Author)

AD-604 929 Div. 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
CONCLUSIONS AFTER USING THE PACT-1 ADVANCED CODING TECHNIQUE,
by I. D. Greenwald and H. G. Martin. 4 Oct 55, 12p P-719

Unclassified report

Descriptors: (*Programming (Computers), Compilers), (*Compilers, Optimization), Errors, Operation, Time, Effectiveness, Systems engineering, Specifications, Digital computers.

From experience with the PACT-1 Advanced Coding Technique as used on the IB Type 701 Data Processing Machine a comparison is made between this coding system and 'machine language' coding with reference to coding time, number and types of errors, 'debugging' time and experience needed by the coder. In addition there are suggestions as to improvements that can be made on future systems and comments substantiating decisions made while writing the specifications for the system. (Author)

Prepared in cooperation with California Univ., Los Angeles.

Descriptors: (*Wind tunnel models, Sublimation), (*Sublimation, Wind tunnel models), Hypersonic flow, Cooling, Aromatic compounds, Polycyclic compounds, Preparation, Sintering, Casting, Recrystallization, Conical bodies, Surface temperatures, Measurement.

A preliminary study of techniques for the preparation of camphor and naphthalene models for experimental research on sublimation cooling in hypersonic flow led to the development of a vacuum sintering technique which yields uniform, homogeneous, clear and easily machinable samples. It is felt, on the basis of static and wind tunnel tests, as well as on the basis of these general observations, that models prepared in this fashion are well suited for accurate reproducible measurements of the history of subliming surfaces and that they will provide reliable data. A method for accurate measurement of surface temperatures during the course of the destructive phase change mass transfer process is proposed and partly developed. If it proves to be totally successful, relatively complete and valuable information on the complex flow field will be obtainable with relatively simple facilities and techniques. (Author)

AD-604 818 Div. 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A QUICK LOOK AT SIMSCRIPT,
by Herbert W. Karr. Oct 62, 24p P-2658
Unclassified report

Presented at Phi Delta Kappa Symposium in Educational Research (no. 4) Indiana Univ, Bloomington, 5 Nov 62. Extracted from Chap. 1 of Markowitz, Hausner, and Karr 'Simscript: A Simulated Programming Language'.

Descriptors: (*Programming (Computers), Simulation), (*Programming languages, Simulation), (*Computers, Simulation), Compilers, Data processing systems, Digital computers.

In SIMSCRIPT, the status of a simulated system is described in terms of entities, attributes of entities, and sets of entities. Status is changed at points in simulated time called events. A separate event routine must be written for each different kind of event to be included in the simulation. For convenience in writing these routines, the SIMSCRIPT source language contains a variety of commands especially adapted to simulation problems. Some of these commands are illustrated.

AD-604 829 Div. 30, 9
OTS Prices: HC $4.00/MF $0.75

Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
AN INVESTIGATION OF CYLINDRICAL STATIC PRESSURE PROBES.
Master's thesis,
by Paul David Smith. Jun 64, 104p
AFIT GAM/ME/64-19
Unclassified report

Descriptors: (*Hydrostatic pressure, Fluid flow), (*Fluid flow, Hydrostatic pressure), (*Pressure gages, Cylindrical bodies), Monometer, Pipes, Angle of attack, Reynolds number, Incompressible flow, Boundary layer, Two-dimensional flow, Nozzles, Fluid mechanics, Temperature control, Velocity, Barometer pressure, Calibration, Measurement, Tables.

The cylindrical pressure probe is a convenient device for the measurement of the static pressure of a fluid stream. The indicated pressure, however, is a function of the angular position of the probe relative to the direction of flow. It is therefore necessary to know the probe angular position at which true static pressure is indicated for the probe-flow situation at hand. In this study values of the probe angular position are determined for ten different probe geometries in a Reynolds number range from 2,500 to 15,000. The method used was to place the probes in a stream of air that is being ejected into the atmosphere. The static pressure of such a stream is equal to the local barometric pressure. Plots of the results show the dependence of the probe angular position on probe diameter, orifice diameter, and Reynolds number.

AD-604 844 Div. 30
OTS Prices: HC $1.00/MF $0.50

Naval Ordnance Lab., White Oak, Md.
MULTIPLE PISTON TWO-STAGE LIGHT GAS LAUNCHER,
by Robert Piacesi and Robert H. Waser. 1 May 64, 22p
NOL TR64 96; NOL BRR130
Unclassified report

Descriptors: (*Light gas guns, Operation), (*Hypervelocity guns, Operation), Ballistics, Pressure, Hypervelocity projectiles, Pistons.

A new method for operating light gas launchers is proposed which provides a significant increase in velocity capability. This method, adaptable to existing launchers, makes use of a second piston in the pumptube. The additional piston provides a second compression of the gas in the pumptube with a corresponding additional push on the projectile resulting in increased velocity. (Author)

AD-604 845 Div. 30, 9
OTS Prices: HC $1.00/MF $0.50

Naval Ordnance Lab., White Oak, Md.
ALKALI METAL ARC TUNNEL,
by H. H. Hoehn, D. Levine, and A. Garcia.
15 Apr 64, 20p
Task FR64
NOL TR64 82; NOL BRR129
Unclassified report

Descriptors: (*Wind tunnels, Design), (*Sodium, Vapors), Liquid metals, Alkali metals, Heating, Electric arcs, Electrodes, Operation.

The design and operation of an aerodynamic wind tunnel which derives its working gas from the arc heating of liquid sodium are described. In particular, the problems of materials and the design of electrodes are discussed. (Author)

AD-604 859 Div. 30, 15
OTS Prices: HC $7.10/MF $1.75

Information Systems Lab., Univ. of Michigan, Ann Arbor.
RESEARCH ON COMPUTER LOGIC AND NUMBER SYSTEMS.
Final rept. for Sep 62-Dec 63,
by H. L. Garner, R. F. Arnold, E. L. Lawler, T. R. Rao, and M. A. Harrison. Jul 64, 406p
Contract AF33 657 7811, Proj. 7062, Task 706205
RTD TDR63 4153
Unclassified report

Descriptors: (*Computer logic, Number theory), (*Number theory, Computer logic), Algebra, Combinatorial analy-

AD-605 032 Div. 30
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
CURRENT DEVELOPMENTS IN COMPLEX INFORMATION PROCESSING,
by Allen Newell and Herbert A. Simon. 1 May 56, 38p P-850
Unclassified report

Presented before a conference on Computers and Automation, Washington, D. C., 2 May 56. Study partly supported by the Ford Foundation.

Descriptors: (*Data processing systems, Information retrieval), (*Programming (Computers), Data storage systems), Mathematical logic, Artificial intelligence, Pattern recognition, Game theory, Programming languages, Mathematical analysis.

A discussion is given of complex information processing; processes which computers perform in complex processing; instructing the computer; and learning and its relation to complex processes.

AD-605 038 Div. 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
PACT-1A,
by T. B. Steel, Jr. Rev. 25 May 56, 8p P-857-AD
Unclassified report

Descriptors: (*Compilers, Programming (Computers)), (*Programming (Computers), Compilers), Programming languages, Mathematics, Control sequences.

A brief description of the Project for the Advancement of Coding Technique on the construction of a compiler for the IBM 704.

AD-605 045 Div. 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
PROFESSOR KOOPMAN ON FALLACIES, A COMMENT,
by Charles Hitch. 21 May 56, 10p P-870
Unclassified report

Descriptors: (*Operations research, Standards), Optimization, Personnel, Costs, Money, Errors, Determination.

This comment followed Professor Koopman's address on 'Fallacies in Operations Research' at the fourth annual meeting of the Operations Research Society of America. It involves the difficult problem of choosing appropriate criteria by the operations researcher and the need for developing theory as a guide to criteria selection.

AD-605 066 Div. 30, 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE STORAGE ALLOCATION OF THE LINEAR PROGRAMMING CODE,
by H. A. Judd. 26 Jul 56, 14p P-907
Unclassified report

Prepared for The RAND Corp. Short Course in Computational Aspects of Linear Programming, 4-13 Sep 56.

Descriptors: (*Linear programming, Compilers), (*Compilers, Linear programming), Control sequences, Programming (Computers).

The handling of storage assignment and subroutine interconnections for the 704 linear programming codes are discussed. The available storage of the machine is divided into two main parts - code and data. Their layouts re fairly independent of one another and the programs include routines for automatic 'housekeeping' during loading and running of a job. Flexibility is provided for systematic modifications in the programs or for machines with various storage facilities. (Author)

AD-605 067 Div. 30, 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ADAPTABILITY OF THE LINEAR PROGRAMMING CODES,
by William Orchard-Hays. 1 Aug 56, 22p P-908
Unclassified report

Descriptors: (*Linear programming, Compilers), (*Compilers, Linear programming), Programming (Computers), Effectiveness, Theory.

The operation of an elaborate set of computer codes raises problems of its own which can only be appreciated from experience. Nevertheless, certain general principles for designing such a system can be set forth. The activities which are engaged in during the evolution of such a system are not simple sequence of events but there is feedback from later steps to earlier ones. How easily the resulting changes can be handled is dependent on the organization of the codes and on the assembly program used. An appendix discusses some shortcomings of the latter together with suggested improvements. (Author)

AD-605 068 Div. 30, 15
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
OPERATING THE LINEAR PROGRAMMING CODES,
by Leola Cutler. 1 Aug 56, 28p P-909
Unclassified report

Descriptors: (*Linear programming, Compilers), (*Compilers, Linear programming), Programming Computers), Control sequences, Errors, Corrections, Standardization.

A general code for solving linear programming problems needs a standardized operating procedure. The current method of operation has evolved from the experience of running many problems. The checks used and the types of error that can be expected are explained. In addition, the way to resume computing after machine or problem error has occurred is discussed. It is shown that with adequate written instructions the problems can be run on the high-speed computer by any machine operator. Major decisions are left to the problem formulator. (Author)

AD-605 072 Div. 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
PREPARATION OF INPUT FOR THE LINEAR PROGRAMMING CODE,
by H. A. Judd. 7 Aug 56, 12p P-914
Unclassified report

Prepared in cooperation with International Business Machines Corp. for the Rand Short Course in Computational

AD-604 931 Div. 30, 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
NOTES ON THE THEORY OF DYNAMIC PROGRAMMING, V. MAXIMIZATION OVER DISCRETE SETS,
by Richard Bellman. Rev. 12 Dec 55, 10p P-721
Unclassified report

Descriptors: (*Dynamic programming, Theory), (*Equations, Dynamic programming), Set theory, Calculus of variations, Functions, Sequences, Mathematical programming, Optimization.

The theory of dynamic programming is applied to a class of problems involving maximization over discrete sets. The solution is made to depend on the solution of a class of functional equations. (Author)

AD-604 959 Div. 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
AN AUTOMATIC SUPERVISOR FOR THE IBM 702,
by Bruse Moncreiff. Rev. 12 Jan 56, 18p P-759
Unclassified report

Presented at the Western Joint Computer Conference in San Francisco on 7 Feb 56.

Descriptors: (*Data processing systems, Supervision), Computers, Operation, Programming (Computers), Automatic, Computer operators.

A description is given of an automatic supervisory routine which is an attempt to solve those operating and programming problems peculiar to the 'routine-dominated' situation of a large commercial data processing center.

AD-604 963 Div. 30, 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
FUNCTIONAL EQUATIONS IN THE THEORY OF DYNAMIC PROGRAMMING. VI. A DIRECT CONVERGENCE PROOF,
by Richard Bellman. 8 Nov 55, 20p P-764
Unclassified report

Descriptors: (*Dynamic programming, Theory), (*Equations, Dynamic programming), Sequences, Calculus of variations, Mathematical programming, Functions.

AD-604 992 Div. 30, 4, 14
OTS Prices: HC $1.00/MF $0.50

Army Research Office, Durham, N. C.
AROD BULLETIN,
ed. by Peregrine White. Aug 62, 10p
AROD 62 8
Unclassified report

Descriptors: (*Free radicals, Nuclear magnetic resonance), Radiation chemistry, Fluorine compounds, Amides, Scientific research, Materials, Mechanical properties, Oxidation, Reviews.

The paper 'Study of free radicals by electron spin resonance', by Robert J. Lontz, is included along with various AROD news and research summaries.

AD-605 003 Div. 30, 28
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A THEORY OF ORGANIZATIONAL BEHAVIOR DERIVING FROM SYSTEMS RESEARCH LABORATORY STUDIES,
by Robert L. Chapman. 12 Mar 56, 12p P-802
Unclassified report

Descriptors: (*Systems engineering, Applied Psychology), (*Applied Psychology, Mathematical models), (*Group dynamics, Adjustment (Psychology), Learning, Human engineering, Training, Personnel management, Management planning, Performance (Human), Motivation, Behavior, Simulation, Theory, Stress (Psychology).

A model for predicting system effectiveness is presented. The variables concern the task, the state of the system, and the forces set in motion when the system comes into contact with its task. Four salient characteristics of the model are pointed out: it identifies task change as critical, it includes crew learning, it identifies the adaptation process as an adjustment cycle, and it describes system state in terms of qualities of the system as a whole. How this model provides criteria for the contributions of human engineering, training, and personnel selection is illustrated by three techniques for improving system performance: the analytic-teaching method, the find-the-right-procedure method, and the build-organizational-potential method. (Author)

AD-605 013 Div. 30
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THOUGHTS ON LINEAR PROGRAMMING AND AUTOMATION,
by George B. Dantzig. 2 Mar 56, 34p P-824
Unclassified report

Descriptors: (*Linear programming, Automation), (*Automation, Linear programming), Scheduling, Computers, Mathematical models, Industries.

The paper views the developments in linear programming toward greater automation.

AD-605 031 Div. 30, 28
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ADMINISTRATION OF RESEARCH IN A RESEARCH CORPORATION,
by John L. Kennedy and G. H. Putt. 20 Apr 56, 22p
P-847
Unclassified report

Descriptors: (*Research program administration, Systems engineering), (*Systems engineering, Research program administration), Group dynamics, Management planning, Supervisory personnel, Professional personnel, Behavior, Applied psychology, Performance (Human), Display systems, Communication systems, Operation.

This paper describes some organizational problems of the new research corporation from the point of view of a research administrator and a researcher. A tool for improving communication between researcher and administrator is described, and its use in planning a large-scale research program is outlined. (Author)

31. Ships and Marine Equipment

AD-604 352 Div. 31, 9
OTS Prices: HC $3.00/MF $0.75

Hydronautics, Inc., Laurel, Md.
SOME RECENT DEVELOPMENTS IN THEORY OF BULBOUS SHIPS,
by B. Yim. Aug 64, 76p Hydro-TR-117-6
Contract Nonr3349 00, Proj. NR062 266
Unclassified report

Descriptors: (*Ship hulls, Fluid dynamic properties), (*Water waves, Ship hulls), Ship structural components, Hydrodynamic configurations, Spheres, Drag, Theory, Reviews.

Contents: ships of minimum wave resistance and bulbous ships; elementary waves and the wave resistance formula; mechanism of bulbous bows; ships with zero bow wave resistance; practical application of the theory of wave cancellation; higher order effect on the elementary waves.

AD-604 354 Div. 31, 9
OTS Prices: HC $2.00/MF $0.50

Maryland Univ., College Park.
AN EXPERIMENTAL STUDY OF THE EFFECTS OF VARIATIONS IN BOUNDARY LAYER THICKNESS AND LIP COVERAGE ON THE PERFORMANCE OF FLUSH SCOOPS,
by Clifford L. Sayre, Jr. Jun 64, 40p
Contract Nonr595 18
Unclassified report

Descriptors: (*Duct inlets, Fluid dynamic properties), (*Condensers (Liquefiers), Duct inlets), Ship auxiliary equipment, Pipes, Flanges, Geometric configurations, Boundary layer, Fluid flow, Pressure.

Two families of scoops were tested in various boundary layer conditions. The maximum pressure coefficient and useful range of flow coefficients decreased with increasing boundary layer thickness. Increasing the coverage improved the maximum pressure coefficient but decreased the useful range of flow coefficients. The family based on the circular inlet pipe proved to be generally superior to the family based on the square inlet pipe. The flush scoop with the circular inlet pipe was more sensitive to variations in free stream velocity and gave variable performance. On the basis of present tests and comparisons with previous test results it was recommended to fail or flare the scoop shape rather than have the inlet pipe intersect the wall abruptly. A numerical analysis of the data was unsuccessful in developing a more effective or concise method for presenting scoop performance data to replace the individual performance curves. (Author)

AD-604 723 Div. 31, 9
OTS Prices: HC $6.00/MF $1.25

California Inst. of Tech., Pasadena.
CALCULATION OF HYDROFOIL SECTIONS FROM PRESCRIBED PRESSURE DISTRIBUTIONS,
by Blaine R. Parkin and Glenn H. Peebles.
16 Jun 55, 213p P-695
Unclassified report

Prepared in cooperation with Rand Corp.

Descriptors: (*Hydrofoils, Design), Specifications, Pressure, Distribution, Incompressible flow, Angle of attack, Velocity, Hydrofoil boats, Mathematical analysis, Tables.

The paper may be regarded as a manual for the design of hydrofoils or airfoils from specifications on the pressure distributions. This design procedure employs the well-known theories of incompressible, inviscid, steady flow and conformal transformations. A profile design is begun by tentatively specifying the pressure distribution desired at selected angles of attack. These specifications which usually conflict with each other are reconciled so as to correspond to an existing but unknown profile. The coordinates of the section are then accurately and rapidly calculated. The purpose of the paper is to give a connected and detailed development of both theory and numerical procedure in the hope that this useful profile design method may find more general application. (Author)

AD-604 753 Div. 31, 17
OTS Prices: HC $1.00/MF $0.50

Naval Applied Science Lab., Brooklyn, N. Y.
UNDER-WATER CORROSION ON USS FISKE (DD-842).
Technical memo. no. 3.
[2 Sep 64], 24p
Proj. SR007 08 07, Task 2822
NASL 9400 34
Unclassified report

Descriptors: (*Ship structural components, Corrosion), (*Corrosion, Ship structural components), Ship hulls, Marine rudders, Destroyers, Anodes.

The last complete overhaul of the USS FISKE, (DD-842) was made in May 1962 at the Charleston Naval Shipyard. The ship was in warm waters for the greater part of the time prior to docking at the New York Naval Shipyard. Principal hull corrosion was found at stern areas and bilge keel vicinity. The ship was initially equipped with thirty-two zinc anodes at the stern. Of these, nineteen remained, but were heavily encrusted with corrosion products. Paint had stripped in areas immediately adjacent to the zincs, but in most cases rust was not evident. Paint was not evident on about 2/3 of the rudder area. The greatest extent of rudder corrosion was found in the vicinity of the aft end of the rudder skegs (both inboard and outboard); pits and striations up to 3/16-inch were observed. Paint was virtually absent in these areas. Under side of port and starboard propeller rope guards were severely corroded, with four bolts missing as a result of corrosion. Corrosion in the vicinity of the starboard bilge keel is shown.

AD-604 785 Div. 31, 21.
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ON THE NEW AMERICAN SUBMARINE 'NAUTILUS' (WITH COMMENTARY AND APPENDICES A-C)
by T. Belashchenko. 1954, 14p T-37
TT 64 71279
Unclassified report

Trans. from Krasnaya Zvezda (USSR) 1954, 19 Jun, p. 4.

Descriptors: (*Nuclear powered vessels, Submarines), (*Submarines, Nuclear propulsion), Performance (Engineering), Marine nuclear propulsion, Ship structural components, Propaganda, Launching, Newspapers, Reports, Naval vessels (Combatant) USSR, United States.

The Russian evaluation of the world's first atomic submarine, nautilus, is presented. Comments by the American press on the vessel are also included.

Aspects of Linear Programming 4-13 Sep 56.

Descriptors: (*Programming (Computers), Input-output devices), (*Linear programming, Programming (Computers)), (*Input-output devices, Preparation), Punched cards, Computers, Control sequences, Compilers, Data processing systems.

This paper describes the format of alphabetic and decimal input cards, their loading sequence and the resulting output of the Data Assembly code. (Author)

AD-605 080 Div. 30, 4, 15
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
PRINTING AND CHECKING FOR LINEAR PROGRAMMING CODES,
by H. A. Judd. 23 Aug 56, 28p P-925
Unclassified report

Prepared for The RAND Corp. Short Course in Computational Aspects of Linear Programming, 4-13 Sep 56.

Descriptors: (*Compilers, Linear programming), (*Linear programming, Compilers), Control sequences, Programming (Computers), Petroleum industry, Refineries, Scheduling, Input-output devices, Printing.

AD-605 101 Div. 30, 26
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
LARGE DATA-HANDLING EQUIPMENT AS A COMMERCIAL TOOL,
by John A. Postley. 19 Nov 56, 28p P-952
Unclassified report

Descriptors: (*Management engineering, Computers), (*Data processing systems, Feasibility studies), Data storage systems, Systems engineering, Economics.

The primary purpose of the paper is to present for management an approach to the employment of large data-handling equipment in commercial problems. This approach is in the form of ideas which, in a very general way, may indicate to management some major requirements to consider and pitfalls to avoid in connection with this employment.

AD-605 107 Div. 30
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
AN EXPERIMENT IN SYMBOLIC WORK ON THE IBM 704,
by John G. Kemeny. 7 Sep 56, 20p P-966
Unclassified report

Descriptors: (*Digital computers, Programming languages), (*Programming languages, Compilers), Computers, Programming (Computers), Data storage systems, Computer storage devices, Numbers, Numerical methods and procedures, Punched cards.

The question as to the availability of a computing machine that is suitable for symbolic work is raised. The present experiment is designed to demonstrate that the 704 is suitable for at least certain types of symbolic problems.

AD-605 110 Div. 30, 26
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
SHARE -- A EULOGY TO COOPERATIVE EFFORT,
by Paul Armer. 31 Oct 56, 24p P-969
Unclassified report

Prepared for presentation at the Electronic Business Systems Conference, San Francisco, 8 Nov 56.

Descriptors: (*Symposia, Data processing systems), (*Data processing systems, Symposia), (*Computers, Commerce), Installation, History, Costs, Training, Programming (Computers), Electronic equipment, Standardization, Libraries.

SHARE is described as a users cooperative. It is made up of most of the organizations who have, or plan on getting, an IBM Type 704 Electronic Data Processing Machine. Its aim is to eliminate, as much as possible, redundant effort expended in using the 704. The history of cooperative effort in the scientific computing field is discussed, and the history of SHARE itself is covered in detail

Descriptors: (*Sociology, Management control systems), (*Operations research, Models (Simulations)), Synthesis, Industrial relations, Culture, Social communication, Management planning, Behavior, Leadership, Social psychology, Group dynamics.

A set of observations on the process by which a group of individuals can become an effective organization is presented. Sections of the paper are concerned with a model of organizational development, mechanisms employed by organizations to deal with complex task situations, and mechanisms available to experimenters and managers to control and stimulate the development of an organization. (Author)

AD-604 383 Div. 32, 13
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
COLD WATER ON SALT WATER,
by William Warthin Taylor. 16 Jul 54, 22p
P-546-RC
Unclassified report

Descriptors: (*Water supplies, United States), (*Desalinization, Economics), Geography, Sea water, Costs, Distribution.

The paper questions the necessity of salt water conversion in order to increase the fresh water supply. It is pointed out that, in the U. S. as a whole, there is no water shortage and that other methods are less expensive than salt water conversion for supplying areas low in water.

AD-604 384 Div. 32, 26
OTS Prices: HC $3.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE NATURE AND APPLICATIONS OF PROCESS ANALYSIS,
by H. M. Markowitz. 24 May 54, 53p P-547
Unclassified report

Descriptors: (*Industrial production, Analysis), (*Economic, Mathematical models), Machine tool industry, Petroleum industry, Linear programming.

The ultimate goal of the process analysis project is to produce a model of the technological capabilities of the economy as a whole. The purpose of the model is to predict what combinations of civilian and military outputs can and cannot be produced with specified national resources. Characteristic of the process analysis approach is the use of detailed engineering data, modern computing techniques and high speed computing machines.

AD-604 387 Div. 32
OTS Prices: HC $3.00/MF $0.75

RAND Corp., Santa Monica, Calif.
EMPLOYMENT AND UNEMPLOYMENT IN THE USSR,
by Warren W. Eason. Rev. 14 Mar 55, 67p P-551
Unclassified report

Descriptors: (*Labor, USSR), Urban areas, Rural areas, Data, Population.

The principal purpose of the paper is to discuss the impact of Soviet planning and economic expansion on the supply of labor, with particular attention to the proportion of the population in the labor force and the distribution by economic sectors; and to examine trends in the percentage of full-time participation of the labor force.

AD-604 394 Div. 32, 26
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
SOVIET HEAVY INDUSTRY: A DOLLAR INDEX OF OUTPUT, 1927/28-1937,
by Alexander Gerschenkron. 30 Aug 54, 27p P-560
Unclassified report

Descriptors: (*Industrial production, USSR), (*Economics, Industrial production), Machines, Iron industry, Steel industry, Petroleum industry, Electrical industry, Costs, Money.

AD-604 401 Div. 32
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A REVIEW OF SVEN RYDENFELT'S COMMUNISM IN SWEDEN,
by W. P. Davison. 8 Oct 54, 40p P-570
Unclassified report

Descriptors: (*Communism, Sweden), (*Sweden, Political science), Reviews.

Sven Rydenfelt's 'Communism in Sweden' analyzes the reasons why Swedes have--or have not--voted the communist ticket in parliamentary elections. It throws new light on the relationship between religion and voting behavior, economic conditions and the communist vote, and the role of the non-communist Left in undercutting the Communist Party in Sweden. Because this study may help illuminate the problem of the communist vote in other countries, the present synoptic review will be made available to interested persons and agencies. (Author)

AD-604 408 Div. 32, 1
OTS Prices: HC $6.00/MF $1.25

Federal Aviation Agency, Washington, D. C.
THESAURUS OF FAA DESCRIPTORS.
Edition no. 1.
Jul 64, 265p
Unclassified report

Descriptors: (*Information retrieval, Aeronautics), (*Aeronautics, Information retrieval), Classification, Documentation, Handbooks, Indexes, Subject indexing, Aircraft.

The thesaurus of FAA descriptors, compiled as part of a program for developing a semi-automated information retrieval system for the FAA, is presented. Descriptors listed were selected in the indexing in depth of approximately 5,600 technical reports. (Author)

AD-604 449 Div. 32, 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
MARKOVIAN AGRICULTURE: SOME FIRST THOUGHTS,
by Frank S. Levy. Aug 64, 13p P-2950
Unclassified report

Descriptors: (*Agriculture, Dynamic programming), (*Dynamic programming, Agriculture), Mathematical models, Probability, Matrix algebra, Nonlinear differential equations, Labor, Money, Optimization, Statistical processes, Economics, Production.

A possible way is offered in which the uncertainty of the agricultural production function can be incorporated into

32. Miscellaneous Arts and Sciences

AD-604 348 Div. 32
OTS Prices: HC $4.00/MF $0.75

Federal Scientific Corp., New York.
A STUDY OF SIGNIFICANT PARAMETERS OF SPEECH FOR APPLICATION IN AUTOMATIC SPEECH RECOGNITION SYSTEMS.
Final rept.
Jul 64, 114p
Contract AF30 602 3131, Proj. 4027, Task 402704
RADC TDR64 196
Unclassified report

Descriptors: (*Speech recognition, Computers), (*Speech transmission, Programming (Computers)).

The report describes work performed on a continuing study of the significant parameters of speech for application in the development of an automatic speech recognition system. Under the present contract the major emphasis was placed on obtaining data for evaluation of critical instants of speech. Critical instants are defined as instants during normal speech when the variation in the values of key speech-parameters is a minimum. Because of the reduced data spread at such instants they will prove to be valuable points at which to sample parameters for use in speech recognition patterns, and will result in higher pattern efficiencies. Procedures are described for the location of critical instants and for evaluation of their significnace for use in recognition patterns. To facilitate these evaluations, modifications were made in a previously developed computer program for extraction of speech parameters, and a new subroutine was added to permit automatic detection of critical instants in a large volume of speech data, and sampling of appropriate parameters at those instants. (Author)

AD-604 359 Div. 32
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
SCIENCE AND STATECRAFT,
by Brewster C. Denny and Emmanuel G. Mesthene.
Oct 61, 18p P-2462
Unclassified report

Descriptors: (*National defense, Scientific personnel), (*Scientific personnel, Political science), Scientific research, Scientific organizations, Government employees.

The paper discusses the role of science in national security.

AD-604 360 Div. 32
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
NOTES ON A CONFERENCE WITH SOVIET SCIENTISTS,
by H. A. DeWeerd, A. L. Horelick, and N. Leites.
Feb 62, 34p P-2542
Unclassified report

Descriptors: (*Scientific personnel, Disarmament), (*Disarmament, USSR), (*Symposia, Disarmament).

AD-604 361 Div. 32
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
LORD RUSSELL, UNILATERALISM AND THE LABOUR PARTY,
by H. A. DeWeerd. Jan 62, 28p P-2509
Unclassified report

Descriptors: (*Disarmament, Great Britain), (*Nuclear warfare, Political science), (*Labor, Political science).

AD-604 371 Div. 32, 18
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
PROBLEMS OF SUPPORT PLANNING,
by Wilbur A. Steger. Apr 62, 14p P-2574
Unclassified report

Descriptors: (*Operations research, Military personnel), (*Military personnel, Management engineering), Decision making, Mathematical programming, Costs, Weapon systems.

The paper discusses what systems analysis, management science, or operational research can do to improve their contributions to support planning.

AD-604 373 Div. 32
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
SOME CONNECTIONS BETWEEN ECONOMIC AND MILITARY ASSISTANCE PROGRAMS IN UNDER-DEVELOPED AREAS,
by Charles Wolf, Jr. 1 Aug 61, 13p P-2389
Unclassified report

Descriptors: (*Armed forces (Foreign), Foreign aid), (*Economics, Foreign aid), (*Government (Foreign), Foreign aid).

Where there are differences or conflicts between economic and military aid, they are often more complex than was, for instance, suggested by a question recently asked in a Congressional Hearing on foreign aid, as to whether guns or jobs are a surer route to stability in the underdeveloped areas. Three connections between economic and military aid as illustrative of this general point are explored. The first connection arises from the character of U. S. objectives in undertaking aid programs in underdeveloped countries. The second is concerned with the role of nonmilitary objectives and criteria in military aid decision-making; and the third connection concerns the problem of incentives for recruiting top-quality personnel to serve in both economic and military aid programs. The first and second are closely related points; the third, clearly, is quite independent.

AD-604 376 Div. 32, 26, 28
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
OBSERVATIONS ON THE GROWTH OF INFORMATION-PROCESSING CENTERS,
by Milton G. Weiner. 21 May 54, 32p P-529
Unclassified report

AD-604 536 Div. 32
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
SOVIET SCHOOLS IN SCIENCE (TRANSLATION AND COMMENTS BY F. J. KRIEGER AND V. S. JITTLOV),
by I. Knunyants and L. Zubkov. 12 Sep 55, 18p T-50
TT 64 71241
Unclassified report

Trans. from Literaturnaya Gazeta (USSR) 1955, 11 Jan, p. 1.

Descriptors: (*Schools, USSR), (*Scientific research, USSR), Scientific personnel. Education.

AD-604 544 Div. 32
OTS Prices: HC $3.00/MF $0.50

RAND Corp., Santa Monica, Calif.
CENTRALIZATION AND DECENTRALIZATION IN ECONOMIC ORGANIZATIONS,
by T. A. Marschak. 7 Jan 59, 57p P-1587
Unclassified report

Descriptors: (*Economics, Management planning), (*Management planning, Economics), Decision theory, Management engineering, Political science.

The paper concerns an economic organization which is an abstraction from the profit-maximizing firm. It concerns the problem which confronts the organization when it has to choose between alternative schemes, exhibiting varying 'degrees' of centralization, for sharing among its members the task of regularly revising its decisions in the face of a changing environment. (Author)

AD-604 564 Div. 32, 28
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
SOCIAL INTERACTION,
by Robert F. Bales. Rev. 14 Dec 54, 28p P-587
Unclassified report

Descriptors: (*Social communication, Group dynamics), (*Group dynamics, Social communication), Social psychology, Decision making, Test methods, Experimental data.

Social interaction and group dynamics are discussed.

AD-604 576 Div. 32
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE EUROPEAN COMMUNITY AND THE SOVIET BLOC,
by Horst Mendershausen. May 62, 17p P-2577
Unclassified report

Descriptors: (*Economics, Europe), (*Commerce, Europe), (*Attitudes, USSR), Communism.

The paper assesses the implications of European unification, particularly economic unification, for the Soviet Bloc.

AD-604 577 Div. 32
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
CHANGES IN THE LOCATION OF FOOD AND GENERAL MERCHANDISE STORE EMPLOYMENT WITHIN METROPOLITAN AREAS, 1948-1958,
by John H. Niedercorn and John F. Kain. Aug 62, 26p P-2614
Unclassified report

Prepared for presentation at the meetings of the Western Economic Association held at the University of California at Los Angeles, Calif., Aug 24, 1962.

Descriptors: (*Industries, Food), (*Distribution (Economics), Industries), Economics, Urban areas, Population, Labor, Production, Mathematical models, Statistical analysis, Statistical tests.

The paper presents an econometric model explaining changes in food and department store employment during the two post-war periods, 1948-1954 and 1954-1958. On the whole, the empirical results presented conform to the a priori model of retail employment location derived earlier. Seven of eight regression equations successfully explain a considerable proportion of the total variation in the dependent variable. Perhaps the most significant finding of the study is the importance of the weighted change in labor-sales ratio variable for the central city equations. This illustrates the importance of technological change, innovation, and other shifts in the production function in determining levels of employment. However, the ring equations show that changes in productivity are not independent of changes in employment and new investment. In rapidly growing areas, changes in employment and new investment appear to influence productivity more than autonomous changes in the latter influence the former. (Author)

AD-604 578 Div. 32
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
HUMAN FACTORS IN SYSTEMS RESEARCH,
by W. W. Haythorn. 7 Jun 61, 33p R-2337
Unclassified report

Descriptors: (*Human engineering, Machines), (*Automation, Human engineering), Simulation, Psychology, Decision making, Personnel, Weapon systems, Logistics, Training.

A number of systems research efforts in which human factors considerations play key roles are described with a view to illustrating techniques for examining human factors problems in a broad systems context.

AD-604 614 Div. 32
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
COMMUNICATING RESEARCH RESULTS,
by Brownlee Haydon. 15 Nov 54, 12p P-599
Unclassified report

Descriptors: (*Reports, Standards), (*Documentation, Effectiveness), Social communication, Military publications, Classification, Scientific research.

AD-604 627 Div. 32, 18
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE SCIENTIFIC STATUS OF PROPAGANDA ANALYSIS,
by Alexander L. George. 15 Dec 54, 21p P-616
Unclassified report

a model of economic growth. An investment decision in agricultural research using dynamic programming in Markov chains is described.

AD-604 457 Div. 32, 30
OTS Prices: HC $3.00/MF $0.50

RAND Corp., Santa Monica, Calif.
DATA PROCESSING FOR CITIES,
by Edward F. R. Hearle and Raymond J. Mason.
Feb 62, 51p P-2492
Unclassified report

Descriptors: (*Data processing systems, Urban areas), (*Urban planning, Data processing systems), Economics, Computers, Input-output devices, Computer storage devices, Communication systems, Punched cards, Programming (Computers), Programming languages, Social sciences, Costs, Automation.

The advancing technology of data processing for cities is discussed. This technology offers benefits of two kinds. First, it enables cities to improve the efficiency of routine data processing activities; and second, data processing technology enables cities to improve the performance of their basic functions.

AD-604 462 Div. 32
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE DISTRIBUTION OF GAINS IN A COMMON MARKET: THE EAST AFRICAN CASE,
by Benton F. Massell. Aug 64, 26p P-2956
Unclassified report

Descriptors: (*Commerce, Africa), (*Economics, Africa), (*Africa, Commerce), Social sciences, Industrial production, Kenya, Tanganyika, Distribution (Economics), Costs, Money.

The East African common market -- composed of Kenya, Uganda, and Tanganyika -- has existed since 1922. Now that the three countries have gained their independence, the governments are deliberating whether the common market should be maintained and, if so, under what arrangements. While there is general agreement that the common market benefits East Africa as a whole, there is some question concerning how the gains are distributed. Some observers have suggested that, although Kenya derives the lion's share of the gains, both Uganda and Tanganyika have gained as well. Others have argued that the gains to Kenya are at the expense of its two partners. In the present study this issue is examined and some suggestions concerning the future operation of the common market are made.

AD-604 483 Div. 32
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
HOW WELL DO WE KNOW THE SOVIET UNION.
by Leon Goure. 7 Sep 61, 15p P-2438
Unclassified report

Descriptors: (*Foreign Policy, USSR), (*Political science, USSR), Economics, Leadership, Industrial production, Motivation, Armed forces (Foreign), Cold war, Propaganda, Communism.

While we go on trying to improve our knowledge and understanding of the Soviet Union, we cannot guarantee ourselves against errors in judgement or occasional surprises from unanticipated Soviet moves. The consequences of the shortcomings in our knowledge of the Soviet Union will be considerably mitigated if the West avoids accepting the passive role of responding to Soviet political initiative and instead pursues a consistent and dynamic policy of its own.

AD-604 516 Div. 32
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A MODEL OF HOUSEHOLD LOCATION AND TRIP-MAKING BEHAVIOR WITH REFERENCE TO DETROIT,
by John F. Kain. Sep 62, 41p P-2627
Unclassified report

In cooperation with the Ford Foundation and the U. S. Air Force Academy.

Descriptors: (*Urban planning, Mathematical models), (*Housing, Urban areas), (*Transportation, Urban areas), Traffic, Labor, Passenger vehicles, Statistical analysis, Costs, Distribution (Economics), Economics, Michigan (State).

This paper deals with the residential and tripmaking behavior of Detroit workers. Residential behavior here refers to the consumption of an interrelated bundle of housing and transportation goods and services. Tripmaking, in this context, is limited to the weekday journey to and from work. The statistical analysis presented here is designed to explore the interrelationships in consumption between housing and transportation. It is hoped the analysis will provide useful information regarding the decisions to locate households in certain areas, and will indicate what implications this information may have for urban transportation and land-use planning.

AD-604 533 Div. 32
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A NOTE ON THE NATIONAL ACCOUNTS OF ALGERIA, 1950-59 and 1964,
by Harold Lubell. Jan 62, 24p P-2524
Unclassified report

Descriptors: (*Economics, Algeria), (*Algeria, Economics), Government (Foreign), Money, Tables.

Figures on most of the national accounts flows for Algeria as published by the French Government are presented. The tables are set out in the framework of the old Ruggles - ICA system of national accounts.

AD-604 534 Div. 32, 18, 28
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
TALMUDISM AND COMMUNIST COMMUNICATIONS,
by Donald S. Zagoria. Sep 62, 37p P-2631
Unclassified report

Descriptors: (*Political science, Communism), (*Communism, Analysis), Propaganda, Foreign policy, Sociology, Psychology.

A discussion of methodoloygy for analyzing Communist communications is presented.

AD-604 677 Div. 32
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
TECHNOLOGICAL CHANGE AND LOCAL ECONOMY,
by D. Novick. Mar 62, 24o P-2568
Unclassified report

This paper was presented at the Economic Development Inst. of Arizona, Tucson, 23 Mar 62.

Descriptors: (*National defense, Budgets), (*Scientific research, National defense), (*Industries, National defense), (*Economics, Scientific research), Costs, Aerospace craft, Spacecraft, Aircraft, Electronics, Weapon systems.

The paper discusses the changes brought about in various industries, particularly the aircraft and space industries, with the coming of the nuclear age.

AD-604 698 Div. 32, 28
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
SYSTEMS BEHAVIOR. II. THE DEVELOPMENTAL PROCESS,
by Milton G. Weiner. Rev. 17 Oct 55, 6p P-660
Unclassified report

Descriptors: (*Sociology, Management control systems), (*Social psychology, Control systems), Group dynamics, Behavior, Learning, Social communication, Leadership, Management planning, Adjustment (Psychology), Air Defense Command, Military organizations.

The developmental process of an organization is examined. Three phases are distinguished; the basal phase, the consolidation phase, and the organization phase.

AD-604 707 Div. 32, 18, 20, 28
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
SOME THOUGHTS ON THE SOCIAL STRUCTURE AFTER A BOMBING DISASTER,
by Jack Hirshleifer. 11 May 55, rev. 18 Aug 55, 31p P-674
Unclassified report

Descriptors: (*Sociology, Warfare), (*Nuclear warfare, Social psychology), (*Bombing, Survival), Political science, Economics, Law, History, Nuclear warfare casualties, Population, Attitudes, Disasters, Urban areas.

The social consequences of a major bombing disaster are explored by an examination of the effects of bombing upon the organization of society, upon the distribution of political and economic power, and upon institutions relevant to the effective functioning of society.

AD-604 714 Div. 32, 15
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
LINEAR PROGRAMMING AND ECONOMIC THEORY,
by Paul A. Samuelson. 25 May 55, 19p P-685
Unclassified report

Descriptors: (*Economics, Linear programming), (*Linear programming, Economics), Operations research, Inequalities, Optimization, Bargaining, Decision theory, Costs, Functions.

AD-604 719 Div. 32,
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A SYSTEM FOR CATALOGING REFERENCE MATERIAL,
by R. P. Johnson, D. J. Blakeslee, and H. Skavdahl.
7 Jun 55, 16p P-690
Unclassified report

Descriptors: (*Punched cards, Information retrieval), (*Information retrieval, Subject indexing), (*Subject indexing, Information retrieval), Catalogs, Classification, Documentation, Reports.

The needle-sort card system for cataloging reference material is discussed. By this system, reports are cataloged according to subject matter by notching out appropriate holes that line the four edges of a card. The sorting process is then accomplished by inserting a needle into the proper row of holes in a deck of such cards, thus permitting the notched cards to separate from the deck. This permits a quick examination of an itimized summary of all available reports that might be of interest.

AD-604 720 Div. 32
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
FILE REFERENCE,
by J. A. Postley. 18 Aug 55, 22p P-691
Unclassified report

Descriptors: (*Information retrieval, Data storage systems), Data processing systems, Programming (Computers), Indexing, Magnetic tape, Magnetic core storage, Documentation.

Suggestions which will be useful in the problem area of reference to large files of information are presented. The conclusions which are drawn or may be implied are presented below. While the problem of indexing is essentially the same in any file reference problem and equipment, it can always be solved by keeping the (exhaustive) index - not the file - up to date. In some cases it is possible to appreciably reduce the size of the index which may be required. Undue emphasis on the factor of pipeline time may be removed in favor of increased emphasis on that of traffic rate. This may be done with the same equipment in three different ways, namely: (1) by approximating the optimum balance of emphasis within a single problem; (2) by emphasizing one of these factors in one problem and another in another problem, within the same framework of mechanization; and (3) by emphasizing one factor, e.g., traffic rate, throughout the problem and handling requests requiring an emphasis of pipeline time reduction as special cases, emphasizing this factor. (Author)

AD-604 746 Div. 32, 12, 14, 17
OTS Prices: HC $3.00/MF $0.75

Aerospace Corp., Los Angeles, Calif.
APPLIED RESEARCH MANAGEMENT ABSTRACT BULLETIN. PART I. ABSTRACTS 1-1704 THROUGH 1-1752.
Jun 62, 70p TDR-930(2701-01)TN 1, pt. 1, no. 12
Contract AF04 647 930
DCAS TN61 3 P1 12
Unclassified report

Descriptors: (*Power supplies, Bibliographies), (*Materials, Bibliographies), (*Bibliographies, Power supplies), Batteries and components, Fuel cells, Nuclear

Descriptors: (*Propaganda, Analysis), Reasoning, Social communication, Language, Psychometrics, Abundance.

When content analysis is used in order to infer antecedent conditions of communication, as is the case in propaganda analysis, logical operations are employed which resemble those necessary to scientific explanation. However, inferences from content analysis do not easily meet the following several requirements of scientific explanation: that general laws be used as part of the explanation; that the phenomenon to be explained be precisely designated; that all relevant antecedent conditions be identified; that the explanation (antecedent conditions and general laws) should bear a logical relationship to the phenomenon explained. In one form in which it was applied, content analysis appears to depart further from scientific inquiry in that it deals with the actual words of the communication and not with a characterization of the communication arrived at by the analyst. (Author)

AD-604 628 Div. 32, 18
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
QUALITATIVE AND QUANTITATIVE PROCEDURES IN CONTENT ANALYSIS,
by Alexander L. George. 15 Dec 54, 38p P-617
Unclassified report

Descriptors: (*Propaganda, Analysis), Language, Reasoning, Abundance.

In the specialized terminology of propaganda analysis, it is useful to distinguish between statements confined to content description and those which constitute inferences from content about its antecedent conditions--e.g., propaganda goals, elite policy calculations, actual events. To avoid the confusion surrounding the distinction between quantitative and qualitative content analysis in the past, a new distinction is proposed, i.e., that between 'frequency' and 'non-frequency' content analysis: (a) If the propaganda analyst believes that the number of times a given content characteristic appears is significant for purposes of inference, this characteristic is regarded as a frequency indicator. (b) However, if he decides that the mere presence or absence of a given content characteristic is significant, then it is regarded as a non-frequency indicator.

AD-604 646 Div. 32, 15, 18, 26
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE FIXED CHARGE PROBLEM,
by Warren M. Hirsch and George B. Dantzig.
1 Dec 54, 22p P-648
Unclassified report

Descriptors: (*Linear programming, Economics), (*Economics, Linear programming), Logistics, Operations research, Functions, Theorems.

A fundamental unsolved problem in the programming area is one in which various activities have fixed charges (e.g., set-up time charges) if operating at a positive level. Properties of a general solution to this type problem are discussed in this paper. Under special circumstances it is shown that a fixed charge problem can be reduced to an ordinary linear programming problem. (Author)

AD-604 665 Div. 32, 12
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE SOVIET UNION AND THE POLITICAL USES OF OUTER SPACE,
by A. L. Horelick. Nov 61, 44p P-2480
Unclassified report

Descriptors: (*Spacecraft, Political science), (*Political science, USSR), Satellites (Artificial), Guided missiles, National defense, Propaganda.

AD-604 674 Div. 32
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
DISARMAMENT AND DETERRENCE,
by Allen R. Ferguson. Apr 62, 42p P-2553
Unclassified report

Descriptors: (*Political science, Cold war), (*Disarmament, USSR), (*Deterrence, USSR), Communism, Nuclear warfare, Social sciences, Foreign policy, Government (Foreign), Economics, Limited war, Arms Control, Western Europe, United States.

This paper has been an attempt to put into perspective deterrence, disarmament, and approaches to peace. The three are viewed as complementary elements in a solution to the problem posed by the political conflict between the democracies and the Soviet Union when both parties have the power of massive destruction. The political conflict appears to arise from the Soviet intention to dominate additional large portions of the world under a system which is apparently entirely incompatible with many values important to the West. Second, it is argued that because of its importance as a political, economic, and military base, Western Europe is a prize of incomparable value to the Soviets if they are intent on world domination. Third, because of the importance of Europe, the Soviets may see hope of success through military action there, with consequent local fighting which may develop into general war. Fourth, it is argued that for the next several years at least the protection of Western Europe must rest ultimately on the threat of nuclear retaliation. Fifth, it follows that the ability to deter aggression in Europe is the major instrument available in the midterm future for reducing the likelihood of general war, that is, for achieving the major objective of disarmament. From this argument some inferences for a general approach to the problem of reducing both the chances and the consequences of war are suggested.

AD-604 676 Div. 32
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
JAPAN AND HER SOVIET NEIGHBOR DURING THE INTERWAR YEARS; JAPANESE IMAGES AND REACTIONS,
by Paul F. Langer. Dec 61, 21p P-2508
Unclassified report

Descriptors: (*Attitudes, Japan), USSR, Communism, Government (Foreign), Propaganda.

about the evaluation of the economy over time. With the help of a few additional assumptions two macro investment functions are deduced from the model. They show that aggregate investment depends on the rate of growth of total output, the gap between desired and actual capital stock, and a change in profit variable to show the state of short run expectations. Statistical testing of the two investment functions on data for investment in plant and equipment in manufacturing is favorable. Unfortunately, the statistical fit of the model is unsatisfactory when tested on data for aggregate investment in plant and equipment in all industries. This result seems to indicate that investment in plant and equipment in all industries is too highly aggregated a concept to analyze with a single investment function. (Author)

AD-604 810 Div. 32
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
COMMUNIST CHINA'S DEMANDS ON THE WORLD,
by A. M. Halpern. 27 Jul 61, rev. 9 Oct 61, 34p
P-2382-1
Unclassified report

Prepared for presentation at meeting of the American Political Scientists Association, St. Louis, 6-9 Sep 61.

Descriptors: (*Foreign policy, China), (*Communism, China), (*China, Foreign policy), Political science, Leadership, Government (Foreign), History, Military strategy, USSR.

The attempt was made to identify goals and methods of Chinese foreign policy. It is suggested that the methods tend to form patterns whose variations through time correlate with changes in the goals pursued. Major changes in the grand design since 1949 have occurred twice--in 1951 and 1957. The controlling factor in such shifts has been the perception of the world distribution of power. The Chinese Communists view the distribution of power basically as bipolar. Depending on their analysis of the bipolar power basically as bipolar. Depending on their analysis of the bipolar power balance, their grand design may identify only enemies outside the Communist bloc or may identify some non-Communist countries as potential temporary allies, but ultimately does not tolerate an independent third power factor.

AD-604 816 Div. 32
OTS Prices: HC $3.00/MF $0.75

RAND Corp., Santa Monica, Calif.
CHINA, THAILAND AND THE SPIRIT OF BANDUNG,
by David A. Wilson. Jul 62, 100p P-2607
Unclassified report

Descriptors: (*Political science, Thailand), (*China, Foreign policy), (*Thailand, Communism), Geography, Social sciences, Social communication, Culture, Population, Government (Foreign), History, Economics, Commerce, Far East, Public opinion, Newspapers, Psychology.

The political relations between the People's Republic of China and Thailand are discussed. The political history, foreign policy, and social and ethnic problems of the two nations are examined.

AD-604 819 Div. 32
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
CONTEMPORARY CHINA AS A PROBLEM FOR POLITICAL SCIENCE,
by A. M. Halpern. Aug 62, 32p P-2617
Unclassified report

Presented at the meeting of the American Political Science Association, Washington, 5-8 Sep 62.

Descriptors: (*Political science, China), (*China, Political science), (*Communism, China), Government (Foreign), Population, Foreign policy, Power, Economics, Leadership.

A range of problems are set forth, referring to the political development of Communist China, whose investigation attempts to advance our understanding of contemporary Chinese politics and produce results of value for the general study of politics. The focus is particularly, but not exclusively, on events since the establishment of the People's Republic of China in 1949.

AD-604 847 Div. 32, 26
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
INSIDE BUREAUCRACY,
by Anthony Downs. Aug 64, 30p P-2963
Unclassified report

Prepared in cooperation with Real Estate Research Corp., Chicago.

Descriptors: (*Sociology, Decision making), (*Decision making, Sociology), (*Group dynamics, Management control system), Economics, Social sciences, Government employees, Performance (Human), Communication systems, Social communication, Group dynamics, Behavior, Political science, Management engineering, Leadership.

A theory of bureaucratic decisionmaking is presented. The theory is based upon the fundamental hypothesis that bureaucratic officials, like all other agents in society, are motivated by their own self interests at least part of the time. Therefore, this theory follows the tradition of economic thought from Adam Smith forward, and is consistent with recent contributions to political science made by such writers as Simmel, Truman, Schattschneider, Buchanan, Tullock, Riker and Simon. The theory consists of the following parts: (1) definition of terms, (2) a few central hypotheses, (3) an assumed environment, and (4) a series of propositions arrived at by logically applying the hypotheses to the environment.

AD-604 848 Div. 32
OTS Prices: HC $3.00/MF $0.50

RAND Corp., Santa Monica, Calif.
AFTER OCTOBER,
by Paul Kecskemeti. Aug 64, 42p P-2959
Unclassified report

Descriptors: (*Political science, Communism), (*Communism, Political science), Government (Foreign), Social sciences, Economics, Leadership, Communists, Eastern Europe, History, USSR.

Variations in the recent political development of communist systems are discussed. The political systems of the USSR and various satellite states are compared and contrasted.

AD-604 850 Div. 32
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.

energy, Solar cells, Thermionic converters, Vehicles, Flight, Rockets, Alloys, Metals, Plastics, Composite materials, Coatings, Indexes, Abstracting.

A bibliography, with abstracts, from unclassified literature is presented on the subject of Flight Vehicle Power. Selected references in the fields of materials are also included. All references are to primary sources. (Author)

AD-604 772 Div. 32, 18
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
UNDETERMINED WAGE PROBLEMS,
by F. Zeuthen. 31 Oct 52, 38p T-25
TT 64 71266
Unclassified report

Undeterminierte Lohnprobleme; trans. from Archiv für Sozialwissenschaft und Sozialpolitik (Germany) 1929, v. 62.

Descriptors: (*Wages, Decision theory), (*Bargaining, Wages), Industrial relations, Labor unions, Labor, Management engineering, Economics, Probability, Mathematical analysis, Warfare.

AD-604 774 Div. 32
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE BRUSH-OFF IS CALLED 'NEW LOOK',
by Klaus Mehnert. 13 Apr 54, 6p T-32
TT 64 71268
Unclassified report

Trans. from Christ und Welt (West Germany) 1954, 18 Mar.

Descriptors: (*National defense, United States), Bombs, West Germany.

Translation of a West German editorial on the atomic bomb strategy of U. S. national defense.

AD-604 776 Div. 32
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
WHEN CAN THE SOVIET UNION RISK ATOMIC WAR,
by Volursus. 1954, 8p T-29
TT 64 71270
Unclassified report

Wann Kann die Sowjetunion Einen Atombonbenkrieg Wagen; trans. from Flug-welt (West Germany) 1954, v. 3, 26 Feb.

Descriptors: (*Nuclear warfare, USSR), Scientific research, Geography, Power plants (Establishments), Uranium, West Germany.

The paper discussed the possibility that the Soviet Union might start an atomic war against the West in 1956.

AD-604 792 Div. 32
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE 22ND CONGRESS OF THE CPSU: SOME DOMESTIC IMPLICATIONS,
by Oleg Hoeffding. Dec 61, 14p P-2493
Unclassified report

Descriptors: (*Economics, USSR), (*Communism, Economics), Government (Foreign), Political science, Labor, Wages, Consumption, Commerce, Propaganda, Symposia.

A discussion of the political and economic assertions of the 22nd Communist Party Congress is presented. A view of Soviet economy in 1980 is projected.

AD-604 794 Div. 32
OTS Prices: HC $3.00/MF $0.75

RAND Corp., Santa Monica, Calif.
THE DEMAND FOR ALCOHOLIC BEVERAGES. AN EXPERIMENT IN ECONOMETRIC METHOD,
by W. A. Niskanen. May 62, 94p P-2583
Unclassified report

Descriptors: (*Beverages, Alcohols), (*Alcohols, Consumption), Control, Law, Costs, Money, Economics, Sociometrics, Game theory, Mathematical models.

Consumers of alcoholic beverages pay higher taxes and are confronted by more extensive public controls than apply to any other major product. A thorough evaluation of the structure of taxes and controls, however, has not been made, since the aggregate characteristics of this market have been poorly understood. The study is designed to provide the basic quantitative framework for an evaluation of these programs. (Author)

AD-604 800 Div. 32, 18
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
KHRUSHCHEV'S ATTACK ON ALBANIA AND SINO-SOVIET RELATIONS,
by Donald S. Zagoria. Nov 61, 36p P-2478
Unclassified report

Descriptors: (*Political science, Communism), (*Eastern Europe, Communism), (*Communism, Foreign policy), Economics, Government (Foreign), Armed forces (Foreign), USSR, China.

The Sino-Soviet struggle over Albania, illustrating the rivalry over power and authority that has existed between Communist China and the USSR since 1956, is discussed. The possibility of a Sino-Soviet split is considered in terms of the differing political idiologies of the two communist nations.

AD-604 805 Div. 32, 15, 26
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A MACRO INVESTMENT MODEL FOR MANUFACTURING,
by John H. Niedercorn. Oct 61, 24p P-2468
Unclassified report

Descriptors: (*Industrial production, Mathematical models), (*Economics, Mathematical models), (*Mathematical models, Economics), Banking, Money, Commerce, Industries, Functions, Statistical analysis.

This article presents the derivation, statistical testing and evaluation of a new investment model for investment in manufacturing industries. It is called an evolutionary model because it is based on some fundamental assumptions

AD-604 955 Div. 32
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
ON REDUCING TENSION,
by Paul Kecskemeti. 10 Oct 55, 14p P-750
Unclassified report

Descriptors: (*Cold war, Foreign policy), (*Foreign policy, Cold war), Political science, Attitudes, Disarmament.

The thesis that one can neither maintain nor reduce chronic international tension by design is pursued.

AD-604 981 Div. 32
OTS Prices: HC $3.00/MF $0.75

RAND Corp., Santa Monica, Calif.
PRICES OF BASIC INDUSTRIAL PRODUCTS IN THE USSR, 1928-50,
by Abram Bergson, Roman Bernaut, and Lynn Turgeon.
12 Jan 56, 68p P-789
Unclassified report

Descriptors: (*Industrial production, USSR), (*Economics, USSR), (*Costs, Industrial production), Industries.

The essay presents some results of an inquiry concerning Soviet industrial price trends for the period 1928-50. The study is one of several that are presently being conducted for various Soviet economic sectors with the common aim to derive index numbers which might be used in the deflation of some recently published current ruble national income data.

AD-604 983 Div. 32, 15
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
DYNAMIC PROGRAMMING AND ITS APPLICATION TO VARIATIONAL PROBLEMS IN MATHEMATICAL ECONOMICS,
by Richard Bellman. Rev. 18 Apr 56, 50p P-796
Unclassified report

Descriptors: (*Dynamic programming, Calculus of variations), (*Calculus of variations, Economics), (*Economics, Calculus of variations), Numerical analysis, Numerical methods and procedures, Operations research.

The purpose of this paper is to discuss some variational problems arising from mathematical economics, and some of the methods that can be used to treat these questions both analytically and computationally. The discussion is limited to important and interesting classes of processes, allocation and smoothing processes, and to a discussion of the application of the theory of dynamic programming to those processes. (Author)

AD-605 007 Div. 32, 28
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A NOTE ON THE POLITICAL ROLE OF MASS MEETINGS IN A MASS COMMUNICATIONS SOCIETY,
by W. P. Davison. 5 Mar 56, 16p P-812
Unclassified report

Descriptors: (*Social psychology, Political science), East Germany, West Germany, Sociology, Political science.

The purpose of the paper is to present a few observations about the functions of political mass meetings which emerged as a by-product from a larger study of the Berlin blockade and airlift of 1948-49. The data on which these observations are based are of a qualitative nature: interviews made by the author with some 20 political leaders in Berlin, reports on public opinion during the blockade prepared by ten public opinion interviewers, essays on their experiences during the blockade submitted to a Berlin newspaper by 340 Berliners, and published materials from the period.

AD-605 027 Div. 32, 18
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
CENSORSHIP IN THE USSR; A DOCUMENTED RECORD,
by Merle Fainsod. 15 Feb 56, 30p P-843-RC
Unclassified report

Descriptors: (*Communication systems, Control), (*Control systems, USSR), Public relations, Documentation, Radio broadcasting, Periodicals, Reports, Textbooks, Propaganda, Communism, Government (Foreign).

The devices by which Soviet mass communication media are controlled and the procedures by which censorship is enforced are discussed. The historical development of censorship in the USSR is traced from the mid-1930's to the present.

AD-605 033 Div. 32
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
POLITICAL BEHAVIOR IN A CRISIS; SOME OBSERVATIONS FROM THE BERLIN BLOCKADE,
by W. P. Davison. 30 Apr 56, 24p P-851
Unclassified report

Presented at the meetings of the American Association for Public Opinion Research, Buck Hill Falls, Pa., 25 May 56.

Descriptors: (*Berlin, Political science), (*Political science, Berlin), Public opinion, Labor unions, Air transportation, Food dispensing, Social psychology, Communism, Population, Leadership, USSR.

The Berlin blockade of 1948 is presented as an opportunity to study mass attitudes and mass political behavior in a crisis. It is concluded that knowledge of attitudes is not a sufficient basis on which to predict political behavior.

AD-605 050 Div. 32
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE REGLE DU JEU OF THE FRENCH PARLIAMENT: AS EXEMPLIFIED IN THE ELECTION OF PRESIDENT COTY,
by Nathan Leites and Constantin Melnik.
22 Jun 56, 22p P-878-RC
Unclassified report

Descriptors: (*Political science, France), (*France, Political science), Leadership, Communism, Government (Foreign), Social sciences, Public opinion, Law.

An analysis of the spirit of contemporary French politics is presented. One important and complicated parliamentary event, the session of the Congress (that is, the combined National Assembly and Council of the

DILEMMAS OF CONTROL AND STRATEGY IN A PLURALISTIC DEMOCRACY; A DISCUSSION OF THE ADMINISTRATIVE POLITICS OF NATIONAL SECURITY POLICY-MAKING IN A DEMOCRATIC POLITICAL SYSTEM,
by Paul Y. Hammond. Aug 64, 20p P-2961
Unclassified report

Paper is being presented at the 1964 Annual Meeting of The American Political Science Association to be held in Chicago, Illinois, September 9-12, 1964.

Descriptors: (*Political science, Foreign policy), (*Foreign policy, United States), (*United States Government, Foreign policy), Decision making, History, Leadership, Social sciences, Warfare, Military operations, National defense.

The dialectic of political responsiveness and operational efficiency in democratic political systems such as the United States is presented. The making and execution of foreign and military policy and the constraints imposed upon them in the setting of administrative politics is discussed.

AD-604 851 Div. 32, 28
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
RISK-AVERSION IN INCENTIVE CONTRACTING: AN EXPERIMENT,
by G. J. Feeny, W. H. McGlothlin and R. J. Wolfson.
Aug 64, 48p RM-4231-PR
Contract AF49 638 700
Unclassified report

Descriptors: (*Probability, Economics), (*Decision making, Economics), (*Economics, Decision making), Commerce, Psychometrics, Management planning, Industrial procurement.

The experiment described here examines the effect of varying the sharing rate in a very simplified incentive contract bidding situation. Subjects were asked to compete for contracts with the bidder's sharing rate varying from .10 to .50. They believed that they were competing against two other subjects and that each contract was awarded to the low bidder. Sixteen undergraduates participated as subjects, and the results showed that both the average bids and expected profit increased monotonically with sharing rate. It is concluded that in this type of experiment, subjects bid so as to increase their expected profits as a function of increasing uncertainty of the outcome. These findings are in general agreement with the literature on risk-taking behavior. These results and the increasing significance of incentive contracts suggest that further study of the relation between bidding behavior and risk is warranted. An experiment with actual procurements is suggested as a means of conducting this investigation. (Author)

AD-604 854 Div. 32
OTS Prices: HC $4.00/MF $0.75

RAND Corp., Santa Monica, Calif.
U. S. PRIVATE INVESTMENT IN LATIN AMERICA: SOME QUESTIONS OF NATIONAL POLICY,
by Leland L. Johnson. Jul 64, 104p RM-4092-ISA
Contract SD79, Proj. ARPA Order189 61
Unclassified report

Descriptors: (*Political science, United States), (*Foreign policy, United States), (*Economics, United States), Government (Foreign), Foreign aid, Costs, Industries, Commerce, United States government, History, South America, Cuba, Public opinion.

A number of economic-political side effects that might have adverse effects on relations between host countries and the United States are examined. Issues that are relevant in formulating future national policy toward U. S. private investment are raised. The nature and sources of conflict that can arise between host countries and U. S. investors are discussed.

AD-604 930 Div. 32
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
DEMOGRAPHIC INTERACTION ANALYSIS AND ITS BEARING ON SMALL GROUP STUDIES,
by F. C. Ikle. 17 Aug 55, 14p P-720
Unclassified report

Descriptors: (*Sociometrics, Urban areas), (*Social communication, Population), (*Population, Functional analysis), Social sciences, Group dynamics, Statistical analysis, Correlation techniques, Behavior.

The interactions of populations in spatially separated areas is analyzed. Statistical and correlation analysis of urban areas and population functions are used to determine interaction frequencies.

AD-604 946 Div. 32
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
RECENT TRENDS IN THE SOVIET ECONOMY,
by Joseph A. Kershaw. 8 Sep 55, 26p P-737
Unclassified report

Descriptors: (*Economics, USSR), Government (Foreign), Industries, Industrial production, Agriculture, Labor, Wages, Distribution (Economics), Consumption, Armed forces budgets, Commerce.

Some recent trends in the Soviet economy from the viewpoint of their influence on Soviet rates of growth are examined. Growth rates in effect before Stalin's death are analyzed in order to evaluate the influence of the post-Stalin changes. Future developments in the economy are predicted with particular emphasis on the probabilities that rates of growth in the future will or will not vary significantly from those that have characterized the past.

AD-604 948 Div. 32
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
RECENT TRENDS IN SOVIET TRADE,
by Oleg Hoeffding. 15 Sep 55, 28p P-739
Unclassified report

Descriptors: (*Commerce, USSR), (*Economics, USSR), Foreign policy, Consumption, Industrial production, Agriculture, Distribution (Economics).

The Soviet record in East-West trade since 1953 and the salient developments in bloc trade are discussed. A detailed scrutiny of Soviet performance in trade with the free world is analyzed to evaluate Soviet claims that the USSR wants more trade as a natural adjunct of peaceful coexistence and relaxed tension. The question of whether the USSR has lately shown evidence of genuinely greater trade-mindedness than it displayed under Stalin is considered.

AD-605 124 Div. 32
OTS Prices: HC $6.00/MF $1.50

RAND Corp., Santa Monica, Calif.
JAPAN'S ECONOMIC FUTURE IN ASIA,
by Donald Stout. 14 Dec 56, 288p P-993-RC
Unclassified report

Descriptors: (*Japan, Economics), (*Economics, Japan), (*Foreign policy, Japan), Commerce, Industrial production, Food, Agriculture, Consumption, Distribution (Economics), Government (Foreign), Statistical analysis, Asia, South Asia, United States government.

The overall purpose of this study was to learn what are likely to be the effects of Asian economic development on Japan and to reach some idea of what role Japan is going to play in that development. The more immediate purpose of the study was to provide some basis for judging whether Japan is likely to succeed in its efforts simultaneously to eliminate its dollar import balance, to pay reparations, and to expand trade with Asia.

Republic) in Versailles, from December 17 to 23, 1953, which resulted in the election of Monsieur Rene Coty to the Presidency of the Republic is studied. The impact of predictions of electoral success and failure on the actual voting is discussed.

AD-605 064 Div. 32
OTS Prices: HC $3.00/MF $0.75

RAND Corp., Santa Monica, Calif.
A COMPARISON OF SOVIET AND AMERICAN RETAIL PRICES,
by Norman M. Kaplan and Eleanor S. Wainstein.
1 May 56, rev. 3 Oct 56, 60p P-901
Unclassified report

Descriptors: (*Economics, USSR), (*United States, Economics), (*USSR, Economics), Costs, Consumption, Wages, Labor, Food, Distribution (Economics), Industrial production, Agriculture, Money, Urban areas, Rural areas, Statistical analysis, Equations.

Retail prices in the US and the USSR are compared. The comparisons are part of a larger project, the purposes of which are: (a) to 'deflate' various components of Soviet and American national product in native currencies; and (b) to analyze differences in ruble-dollar price ratios for various commodities and commodity groups.

AD-605 069 Div. 32, 26
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
A MIN-MAX SOLUTION OF AN INVENTORY PROBLEM,
by H. E. Scarf. Rev. 24 Jun 57, 18p P-910
Unclassified report

Descriptors: (*Stock level control, Mathematical analysis), Distribution (Economics), Distribution theory, Inventory control, Costs.

The paper is concerned with the problem of purchasing a quantity of an item in anticipation of a future demand. It is assumed that only the mean and standard deviation of the demand distribution are known. A stock level is found which maximizes the minimum profit for all demand distributions with this mean and standard deviation. This stock level is then compared with the levels obtained by assuming several specific distributions. (Author)

AD-605 088 Div. 32, 18
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE ROLE OF THE MILITARY IN POST-STALIN SOVIET POLITICS,
by Raymond L. Garthoff. 12 Sep 56, 24p P-937
Unclassified report

Based on the author's monograph, 'The Role of the Military in Recent Soviet Politics', RM-1638, The RAND Corp., 1 Mar 56.

Descriptors: (*Military personnel, USSR), (*Political science, USSR), Leadership, Officer personnel, Communists, Economics, Armed forces (Foreign), Government (Foreign).

The death of Stalin, which ushered in a new era in Soviet history, and its effect on the military are discussed. The particular causes of the shift in the role of the military in Soviet affairs, increasing the political status and influence of the military leadership, are examined.

AD-605 095 Div. 32
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE RUSSIAN FUTURE: IS A NEW OPTIMISM JUSTIFIED,
by Robert C. Tucker. 20 Sep 56, 20p P-945
Unclassified report

Prepared for publication in The New Leader.

Descriptors: (*Foreign policy, USSR), (*Political science, USSR), Communism, Government (Foreign), Leadership, Military personnel, Propaganda.

Khrushchev's expose of the Stalin tyranny at the Twentieth Party Congress, the ensuing campaign of De-Stalinization and their effect on Western attitudes toward the present situation and prospects in Soviet Russia are examined. The American opinion, under the impact of these events, is a prevailing pessimism which has given way to a nascent optimism.

AD-605 109 Div. 32, 18
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
SCIENTIFIC PROGRESS AND POLITICAL SCIENCE,
by Bernard Brodie. 25 Oct 56, rev. 30 Nov 56,
22p P-968
Unclassified report

Prepared for presentation at the meeting of the American Association for the Advancement of Science, 26 Dec 56. To be published in the Spring issue of Scientific Monthly and in the Special Publications Series of the National Academy.

Descriptors: (*Symposia, Political science), (*Political science, Advanced weapons), (*Scientific research, Political science), Scientific organizations, Scientific personnel, Social sciences, Public opinion, Foreign policy, Warfare, National defense, United States government.

The problems facing political scientists today regarding policy decisions which affect national security are discussed. Political science is viewed in terms of its historical development and limitations, with emphasis being placed upon its relationship to military policy in matters of national and international significance.

AD-605 111 Div. 32
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
SOVIET ECONOMIC AID IN SOUTHEAST ASIA: THREAT OR WINDFALL,
by Charles Wolf, Jr. 6 Dec 56, 18p P-972-RC
Unclassified report

Descriptors: (*Foreign aid, South Asia), (*Foreign policy, USSR), Economics, Political science, United States government, Countermeasures.

The new Soviet diplomacy in Asia, involving an active effort to extend economic aid to a select group of countries who qualify as non-allied with the United States, or, in some sense of the term, as neutralists, is discussed. To date, the Soviet Bloc has made aid commitments in South and Southeast Asia of over $380 million to India, Afghanistan, Indonesia, Cambodia, and Burma. Virtually all the aid has been committed in the past two years; most of it since early 1956. The scope and timing of the Bloc's aid efforts raise a number of basic questions for United States foreign economic policy: Is Soviet aid in Southeast Asia a clear threat to U. S. interests. Should offers of aid by the Bloc be responded to by U. S. counter-offers of more aid on more favorable terms. And what can be said about the effect of Soviet aid to non-allied countries on our SEATO allies.

portation), Mathematical programming, Mathematical models, Air Force operations, Matrix algebra, Computers Costs, Training.

This report involves an attempt to determine whether MATS airlift planning could be improved by the substitution of linear programming methods for trial-and-error rule-of-thumb methods. The experiment was not successful for the following reasons. The gains were not spectacular, being on the order of two or three per cent in terms of the potential increase in useful airlift from the existing resources, and on the order of one day in fourteen in terms ot reduction of the length of the planning cycle. The costs promised to be rather high, because to realize the potential gains it would be necessary for MATS to have a guarantee of immediate access at unpredictable times to an expensive electronic computing machine. Above all, the lack of mathematical training among the middle management group makes it far easier for an organization such as MATS to accommodate itself to trial-and-error methods rather than to linear programming methods. (Author)

33. Transportation

AD-604 379 Div. 33, 1
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
AIR CARGO TRANSPORT SCHEDULING, AN ILLUSTRATIVE BLOCK TRIANGULAR SYSTEM,
by Alan S. Manne. 11 Jun 54, 12p P-533
Unclassified report

Legibility of this document is in part unsatisfactory. Reproduction has been made from best available copy.

Descriptors: (*Scheduling, Transport planes), Linear programming, Mathematical models, Operations research, Combinatorial analysis, Air transportation, Cargo.

A linear programming model of air transport operations that is block triangular in nature is discussed.

AD-604 395 Div. 33
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
THE PROBLEM OF ROUTING AIRCRAFT, A MATHEMATICAL SOLUTION,
by A. R. Ferguson and G. B. Dantzig. 1 Sep 54, 30p P-561
Unclassified report

Descriptors: (*Linear programming, Air transportation), (*Air transportation, Economics), Aircraft, Costs, Optimization, Iterative methods.

A method for assigning a given fleet of several different types of aircraft to carry an anticipated traffic load over several routes at minimum cost is presented and explained. The application of linear programming to transportation problems of this general type is illustrated.

AD-604 716 Div. 33, 11
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
DETERMINATION OF THE MAXIMAL STEADY STATE FLOW OF TRAFFIC THROUGH A RAILROAD NETWORK,
by Alexander W. Boldyreff. 5 Aug 55, 41p P-687
Unclassified report

Descriptors: (*Traffic, Railroads), Transportation, Railroad cars, Statistical analysis, Game theory, Models (Simulations), Determination.

A simple and rapid method of estimating the maximal steady state flow of traffic through a railway network is described and illustrated by examples. The method, as presently described, is entirely empirical in character and no generality is claimed. Essentially, it is an illustration of the application of the techniques of gaming to certain classes of mathematical problems. (Author)

AD-604 934 Div. 33
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
CARGO DENSITY VARIATIONS: A CHALLENGE TO AIR TRANSPORT,
by R. E. Bickner, 24 Aug 55, 50p P-724
Unclassified report

Descriptors: (*Air transportation, Cargo), (*Cargo, Air transportation), Economics, Cargo planes, Payload, Design, Costs.

It is shown that cargo densities, and particularly variations in cargo density from flight to flight, are important in many phases of air transportation. These variations affect the matching of airlift capabilities with airlift requirements; the designing of transport aircraft; the selecting of aircraft for a fleet; the routing of aircraft; and the allocating of airlift. It is emphasized that cargo densities vary considerably from flight to flight and from route to route. When one thinks and plans in terms of some average density, as if cargo densities were always the same, one runs the risk of making wrong decisions and promoting inefficiency. In many instances these mistakes can be avoided and examples are given of how better estimates and decisions might sometimes be reached. (Author)

AD-604 968 Div. 33, 15, 26
OTS Prices: HC $1.00/MF $0.50

RAND Corp., Santa Monica, Calif.
NOTES ON THE THEORY OF DYNAMIC PROGRAMMING---VII. TRANSPORTATION MODELS,
by Richard Bellman. 28 Nov 55, 12p P-771
Unclassified report

Descriptors: (*Transportation, Mathematical models), (*Dynamic programming, Transportation), (*Scheduling, Transportation), Optimization, Equations, Stochastic processes, Multiple operation, Operations research, Management engineering.

The purpose of this paper is to illustrate some applications of the functional equation technique of the theory of dynamic programming to a general class of problems arising in the study of networks, particularly those arising in transportation theory. (Author)

AD-605 056 Div. 33, 15
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
HITCHCOCK TRANSPORTATION PROBLEM,
by D. R. Fulkerson. 9 Jul 56, 30p P-890
Unclassified report

Descriptors: (*Linear programming, Transportation), (*Transportation, Linear programming), Matrix algebra, Calculus of variations, Combinatorial analysis, Economics.

An exposition of the simplex computation for transportation type problems. (Author)

AD-605 087 Div. 33, 15, 18, 30
OTS Prices: HC $2.00/MF $0.50

RAND Corp., Santa Monica, Calif.
COSTS AND BENEFITS IN MATHEMATICAL PROGRAMMING,
by A. S. Manne. 27 Aug 56, 38p P-936
Unclassified report

Prepared in cooperation with Yale Univ., New Haven, Conn., Contract Nonr609 01. Study made with the cooperation of the Military Air Transport Service and the Cowles Foundation for Research in Economics. Legibility of this document is in part unsatisfactory. Reproduction has been made from the best available copy.

Descriptors: (*Scheduling, Air transportation), (*Air transportation, Scheduling), (*Linear programming, Air trans-

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NON-MILITARY AND OLDER MILITARY RESEARCH REPORTS

1. Aircraft and Flight Equipment

PB-160 110 Div. 1, 16
OTS Prices: HC $2.00/MF $0.50

Naval Medical Research Inst., Bethesda, Md.
MEASUREMENTS OF THE LOADS REQUIRED TO BREAK COMMERCIAL AVIATION SAFETY BELTS AS AN INDICATION OF THE ABILITY OF THE HUMAN BODY TO WITHSTAND HIGH IMPACT FORCES.
Rept. no. 12,
by Edward M. Wurzel, Lewis J. Polansky, and Earl E. Metcalfe. 16 Mar 48, 30p
Proj. NM001 006X630

Unclassified report

Descriptors: (*Safety harness, Aviation safety), (*Impact shock, Safety harness), (*Aviation accidents, Safety harness), Force (Mechanics), Load distribution, Strain (Mechanics), Failure (Mechanics), Humans, Body, Test methods, Fibers, Deceleration, Commercial planes, Aviation medicine.

The force required to break aviation safety belts used in private aircraft was determined in order to correlate this force with the trauma recorded in the reports of private aircraft crashes. The force was determined by using a new method of testing which closely simulates the conditions believed to exist in actual aircraft crashes. The results indicate that in private aircraft crashes man has frequently survival impact loads of 2500 pounds with no signs or symptoms of injury. (Author)

2. Astronomy, Geophysics and Geography

PB-166 084 Div. 2, 30
OTS Prices: HC $2.00/MF $0.50

Research and Advanced Development Div., Avco Corp., Wilmington, Mass.
COMPUTER METHODS FOR HANDLING THE K AND Q INDICES.
Antarctic research and data analysis scientific rept. no. 10,
by H. Nissim and G. F. Rourke. 15 Nov 63, 41p
RAD-TR-63-41
Grant NSF C255

Unclassified report

Descriptors: (*Solar radiation, Programming (Computers)), (*Terrestrial magnetism, Polar regions), (*Programming (Computers), Geophysics), Programming languages, Harmonic analysis, Data, Magnetic fields.

Presented and discussed are computer programs for reducing the K and Q indices to an analytical form. Computations were performed on an IBM 1410 computer and applied to IGY and IGC data. The indices were reduced in the following ways: (a) the days in a month were ranked in order of magnetic activity by using the K index, (b) the frequency distribution of K indices in each month was determined, (c) the K values were converted to ak values and three-hour and monthly means were computed for all, quiet, and disturbed days, and (d) the Q index was harmonically analyzed. (Author)

8. Electronics and Electronic Equipment

AD-429 048 Div. 8, 2, 5, 30
OTS Prices: HC $3.00/MF $0.75

Stanford Electronics Labs., Stanford Univ., Calif.
THE EFFECTS OF THE AURORA ON RADIO-WAVE PROPAGATION.
Final rept.,
by A. M. Peterson. Oct 63, 84p SEL-63-127
Contract AF19 604 1830
AFCRL 64 100

Unclassified report

Descriptors: (*Aurorae, Radio transmission), (*Radio transmission, Aurorae), Radio waves, Propagation, Electromagnetic wave reflections, Scattering, Radar, Radio interference, Radar interference, Ionosphere propagation, Analog computers, Geometry, Equations, Polar regions, Communication systems.

The research included study of backscattering and forward scattering of radio waves by the aurora based on experiments in Alaska. Large-scale traveling disturbances in the F region which travel southward from the auroral zone were studied by observing their effects on the PPI photograph of long-distance ground-backscatter signals. Long-range, ionospherically propagated, auroral-zone radio echoes were observed from Stanford and ray tracings using an analog computer were prepared to help in explaining origin of the echoes. Radio noise believed to be associated with the aurora was observed in the 20- to 50-Mc frequency range, and mechanisms for noise generation were studied. The research also included study of the characteristics of field-aligned ionization irregularities thought to be responsible for radio reflections by the aurora. (Author)

AD-433 101 Div. 8, 25
OTS Prices: HC $12.40/MF $3.75

Army Electronics Research and Development Agency, Fort Monmouth, N. J.
PROCEEDINGS OF THE ANNUAL SYMPOSIUM ON FREQUENCY CONTROL (17th).
29 May 63, 940p

Unclassified report

Symposium held 27, 28, 29 May 63, Shelburne Hotel, Atlantic City, N. J.

Descriptors: (*Symposia, Frequency), (*Frequency, Control), (*Electronics, Symposia), Electronic equipment, Resonators, Crystals, Piezoelectric crystals, Quartz, Crystal filters, Quartz resonators, Filters (Electromagnetic wave), Oscillators, Masers, Electron tubes, Lasers, Design, Standards, Circuits, Measurement.

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605 117	15
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605 119	18
605 120	20
605 121	26
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16. Medical Sciences

PB-160 069 Div. 16
OTS Prices: HC $1.00/MF $0.50

Naval Medical Research Inst., Bethesda, Md.
THE RELATIONSHIP BETWEEN THE FEVER CAUSED BY BACTERIAL PYROGENS AND THE FEVER PRODUCED BY THE INTRAVENOUS INJECTION OF ACUTE STERILE EXUDATES.
Rept. no. 2,
by Ivan L. Bennett, Jr., and Barton S. Holderman.
12 Mar 48, 14p
Proj. NM007 047

Unclassified report

Descriptors: (*Fevers, Bacterial extracts), (*Pyrogens, Tolerances (Physiology)), (*Body fluids, Fevers), Vaccines, Immunology, Injections (Medicine), Dogs, Rabbits, Body temperature, Salmonella typhosa, Escherichia coli, Pathology, Globulins, Thorax, Desoxyribonucleic acids, Ribonucleic acids.

The relationship between the fever caused by bacterial pyrogens and the fever following intravenous injection of acute sterile exudates in rabbits was investigated by comparing the responses of normal and pyrogen-tolerant animals to injections of exudates. Exudates were produced by the intrapleural injection of turpentine in dogs. Usually, although not invariably, the fever-promoting substance appeared in the chest fluid after the reaction of the exudate had progressed from alkaline to acid over a period of four or five days. Animals receiving daily injections of exudate failed to develop tolerance to its temperature-raising effect, in sharp contrast to the progressive lessening of febrile response in animals given a course of daily injections of bacterial pyrogen. Animals rendered tolerant to bacterial pyrogens (Salmonella typhi and Escherichia coli vaccines) showed no tolerance to exudates, and tolerance for bacterial pyrogens was lost during a course of daily injections of exudate. It was concluded that the substance in sterile exudates which causes fever in rabbits is not a bacterial pyrogen. (Author)

PB-160 089 Div. 16
OTS Prices: HC $1.00/MF $0.50

Naval Medical Research Inst., Bethesda, Md.
PHOTOFLUOROMETRIC DETERMINATION OF GALLIUM IN TISSUES.
Rept. no. 1,
by Horace C. Dudley. 5 Jan 48, 14p
Proj. NM011 013

Unclassified report

Descriptors: (*Tissues (Biology), Gallium), (*Gallium, Tissues (Biology)), (*Fluorometers, Biological assay), Biochemistry, Toxicity, Organic materials, Sulfuric acid, Sodium compounds, Hydroxides, Chloroform, Ph, Test methods, Hydrochloric acid, Measurement, Metals, Impurities, Fluorescence.

An analytical method was developed for the determination of gallium (Ga) in organic and biological materials. The sample is digested with sulfuric acid, the excess acid is neutralized with NaOH, and 8-hydroxyquinoline is added. The solution is extracted with chloroform after the pH has been adjusted between 6-8. The extracted dye complex is evaporated to dryness, ignited at 650C., and taken up in dilute HCl. This solution is treated with 8-hydroxyquinoline solution at pH 2.5-2.8 and extracted with chloroform. The fluorescence of the chloroform extract is measured in a photofluorometer, using a mercury arc as the light source. The method is useful in the range of 2 to 100 micrograms of gallium. (Author)

PB-160 090 Div. 16
OTS Prices: HC $1.00/MF $0.50

Naval Medical Research Inst., Bethesda, Md.
THE PHYSIOLOGICAL BASIS OF UNCONTROLLED CROSS-CIRCULATION IN DOGS.
Research rept., vol. 13, p. 213-224,
by R. H. Egdahl. 17 May 55, 16p
Proj. NM007 081 21 01

Unclassified report

Descriptors: (*Kidneys, Transplantation), (*Blood transfusions, Transplantation), (*Transplantation, Blood transfusions), Blood circulation, Pulse rate, Body temperature, Drugs, Cannulation, Labeled substances, Arteries, Veins, Surgical techniques, Tolerances (Physiology), Shock (Pathology), Dogs.

Uncontrolled cross-circulation is a simple procedure for effectively mixing the blood streams of two animals. It has a low mortality and morbidity, and may be repeated days or weeks after the initial procedure without danger. Mean blood pressure, pulse rate, and temperature values in the cross-circulated partners vary independently, and flows of from 200-750 cc/minute are obtained. The blood streams of the animals are rapidly and thoroughly mixed, and drugs injected in one partner appear in the other in less than 30 seconds. Regulation of flow in the cross circulation technique is unnecessary for most investigative and therapeutic applications, provided the polyethylene tubing connections between the two animals are of the same diameter. (Author)

PB-160 093 Div. 16
OTS Prices: HC $1.00/MF $0.50

Naval Medical Research Inst., Bethesda, Md.
PLASMA POTASSIUM CURVES IN THE RABBIT, FOLLOWING SINGLE AND REPEATED INJECTIONS OF POTASSIUM CHLORIDE.
Research rept.
by R. Truscoe and R. L. Zwemer. 18 May 53, 16p
Proj. NM007 081 02 11

Unclassified report

Descriptors: (*Potassium, Toxic tolerances), (*Toxic tolerances, Potassium), Potassium compounds, Chlorides, Rabbits, Blood plasma, Electrolytes(Physiology), Injection (Medicine), Shock (Pathology), Toxicity, Cells (Biology), Pathology, Lethal dosage.

Plasma potassium levels, in 11 tolerance curves after injection of KCl solutions, were determined by a micro method developed by the authors and currently modified. Single intraperitoneal injections of more than 0.575 gm. KCl/kg. body weight cause death within 15 to 30 minutes, with terminal plasma K values ranging from 58 to 85 mg/100 ml. When a subiethal dose of KCl is repeated at 24- or 72-hour intervals, the elevations in plasma K are greater and more prolonged than after an initial dose. The curves are interpreted as indicating rapid transfer of plasma K into cells, some constituent of which can combine with K ions until saturated. Renal elimination effect in lowering plasma K is thought to be at a slower rate. Single plasma K determinations give little evidence of the ability of an individual to cope with an abnormal increment in potassium. (Author)

PB-160 095 Div. 16
OTS Prices: HC $1.00/MF $0.50

Naval Medical Research Inst., Bethesda, Md.
POTASSIUM TOLERANCE IN VARIOUS ANIMAL SPECIES.
by Raymund L. Zwemer. 22 May 50, 14p
Proj. NM007 081 02 09

Unclassified report

A collection of documents dealing with frequency control in the areas of fundamental studies, quartz crystal development and engineering, quartz crystals and circuitry atomic and molecular frequency control, and circuits and measurements.

10. Fuels and Combustion

PB-166 081 Div. 10, 17
OTS Prices: HC $2.00/MF $0.50

Montana State College, Bozeman.
THE CHARRING OF WESTERN COALS.
Research and development rept. for 1 Jul 62-31 Dec 63,
by L. Berg and R. L. Nickelson. 31 Dec 63, 32p
Contract 14 01 0001 274
OCR RDR4

Unclassified report

Descriptors: (*Coal, Decomposition), (*Decomposition, Coal), Carbon, Creosote, Gases, Chemical analysis, Refining (Metallurgy), Economics, Purification, Fuels, Processing, Phosphorus, Lead, Processing.

Four coals were investigated for the production of char, creosote, and gas in a concentric vertical stainless steel tube carbonizer. Tested were 2-inch minus coal from O'Donnell No. 2 mine at Glenville, West Virginia; Brophy mine at Red Lodge, Montana; Kenilworth mine at Castle Gate, Utah; and the Elkol mine at Kemmerer, Wyoming. Yields of char, creosote, and gas were determined at 1000F, 1250F, 1500F, and 1750F. A thirty-day continuous run with the Utah coal was made at 1700F to demonstrate the reliability of the equipment. An economic evaluation of the process as a substitute source for coke in the West is presented. Recommendations for future work include the suggestion that the char from these coals be converted into briquets suitable for the elemental phosphorus and non-ferrous metal smelting industries. (Author)

12. Guided Missiles

PB-166 105 Div. 12, 25
OTS Prices: HC $2.00/MF $0.50

Electronics Research Lab., Univ. of California, Berkeley.
ON SYSTEMS OF AUTOMATIC CONTROL OF THE ROTATION OF A RIGID BODY,
by Richard E. Mortensen. 27 Nov 63, 49p ERL-63-23
Grant NSF G15965

Unclassified report

Descriptors: (*Attitude control systems, Spacecraft), (*Rotation, Control), Trajectories, Dynamics, Motion, Moments, Vector analysis, Matrix algebra, Automata.

The purpose of the paper is not only to present a review of rigid-body dynamics but also to present a formulation which appears to be especially suitable for treatment by the techniques of Lyapunov and Pontryagin for studies of stability and optimization. From this formulation, which is based on quaternions, the Cayley-Rodriguez parameters are developed. These parameters permit the development of the complete dynamical equations for the control problem in a way which suggests a suitable control law for an automatic regulator. The Second Method of Lyapunov is used to prove that this regulator is asymptotically stable in the large. It is not claimed that the regulator is optimal in any sense. Rather, the purpose is to illustrate how the inherent structure of the dynamical equations plus some insight, based on the anticipated use of Lyapunov's test for stability, can suggest an (a.s.l.l.) control law. Finally, the actual problem of optimization, to which Pontryagin's principle may be applied, is surveyed briefly. (Author)

13. Installations and Construction

PB-166 247 Div. 13, 26
OTS Prices: HC $6.00/MF $2.50

Burns and Roe, Inc., New York.
SALINE WATER CONVERSION DEMONSTATION PLANT NO. 2, SAN DIEGO, CALIFORNIA.
Annual rept. no. 2, 1 Jul 63-26 Feb 64.
Jul 64, 288p
Contract 14 01 0001 233
OSW PR114

Unclassified report

Descriptors: (*Distilling plants, Sea water), (*Sea water Desalination), (*Desalination, Sea water), Performance (Engineering), Maintenance, Operation, Costs, Corrosion, Marine biology, Evaporators, Heat transfer, Computers, PH, Salinity, Pipes, Steel, Air ejectors, Pumps, California, Management engineering.

History, organization, plant operation and maintenance, problem areas, achievements and recommendations, and costs and production of the San Diego conversion demonstration plant No. 2 are given.

15. Mathematics

AD-280 453 Div. 15
OTS Prices: HC $1.00/MF $0.50

Case Inst. of Tech., Cleveland, Ohio.
RELATIONSHIPS BETWEEN MOMENTS OF NORMAL AND CHI (1 d.f.) ORDER STATISTICS,
by Zakkula Govindarajulu. Mar 62, 14p
Case-Pub-1057
Grant AF AFOSR62 72
AFOSR 3340; N62 17614

Unclassified report

Descriptors: (*Statistical analysis, Integrals), Population (Mathematics), Sampling, Integration.

Formulae expressing the (regular and mixed) moments of order statistics and expected values of the quasi-ranges in samples from the standard normal population, purely in terms of the moments of order statistics in samples from 'the folded standard normal' population or chi-population with 1 d.f., are derived. Only certain moments of chi-order statistics can be expressed in terms of the moments of the normal order statistics. The cumulative rounding error involved in using these formulae recursively, is studied. (Author)

it is shown that, by maintaining a rigid distinction between freezing and nonfreezing injuries, a working hypthesis for the mechanism of injury may be established which is in concord with clinical observations as well as with many apparently conflicting experimental results. (Author)

PB-160 114 Div. 16
OTS Prices: HC $1.00/MF $0.50

Naval Medical Research Inst., Bethesda, Md.
METABOLIC STUDIES OF INTACT PERFUSED CALF ADRENALS USING TETRAZOLIUM.
Research rept., vol. 13, p. 805-820,
by George Rosenfeld. 15 Nov 55, 18p
Proj. NM006 012 04 88

Unclassified report

Descriptors: (*Adrenal glands, Metabolism), (*Metabolism, Adrenocorticotropic harmones), (*Adrenal cortex hormones, Radiation effects), Endocrine glands, Tissue extracts, Biosynthesis, Enzymes, Inhibition, Organic compounds, Oxidoreductases, Gamma rays, Steroids, Amino acids, Fatty acids, Glycolysis, Carbohydrates, Biochemistry.

A simple aerobic and anaerobic (N2 plus TTC) perfusion technique was employed to study the intermediary metabolism of intact calf adrenals and the effect of disparate chemical and physical agents on their metabolic activity and steroidogenic function. The results demonstrated that Meyerhof-Embden and Krebs-Johnson carbohydrate intermediates were rapidly oxidized in contrast to amino and fatty acids. Studies with various selective enzyme inhibitors confirmed the role of the glycolytic and terminal aerobic pathways. The nature and intensity of the effects of these agents on the steroidogenic processes paralleled those on the metabolic activity with the striking exception of Amphenone B, which produced only a minor decrease in the oxidative metabolism and one of 75 percent in corticoid output. A 24-hour incubation at 8C. and exposure to gamma radiation (1,900-2,700 r) revealed a similar dissociation between their effects on the metabolic and steroidogenic activities of the adrenal. Thus, while a pronounced decline in metabolic activity was invariably associated with a diminution in biosynthetic function, the latter can be markedly depressed without a corresponding depression in the former. (Author)

23. Personnel and Training

PB-166 082 Div. 23, 16, 30
OTS Prices: HC $3.00/MF $0.75

Battelle Memorial Inst., Columbus, Ohio.
THE EVALUATION AND STANDARDIZATION OF SELECTION AND TRAINING PROCEDURE FOR THE BATTELLE AURAL READING DEVICE.
Final rept. for 1 Jul 62-30 Jun 63,
by John L. Coffey and Ray R. McFarland. 30 Jun 63, 65p
Contract V1005M1961

Unclassified report

Descriptors: (*Reading machines, Training devices), (*Training devices, Reading machines), Hearing, Blindness, Performance tests, Selection, Standardization.

The following conclusions were drawn: (1) Selected and screened blind subjects can perform satisfactorily with the reading device. (2) The present 200-lesson training program, with a few possible modifications, appears to be one successful method of training these subjects. All training and use of the reading device should incorporate mechanically-aided tracking.

26. Production and Management

AD-401 487 Div. 26, 17
OTS Prices: HC $5.00/MF $1.00

Universal-Cyclops Steel Corp., Bridgeville, Pa.
DETERMINATION OF THE EFFECTS OF PROCESSING REFRACTORY METALS UNDER VACUUM.
Final rept. for 1 Apr 61-31 Mar 62,
by F. R. Cortes. Feb 63, 182p
Contract AF33 616 8212, Proj. 7381, Task 738103
ASD TDR62 618

Unclassified report

A portion of the original document contains fine detail which may make reading of photocopy difficult.

Descriptors: (*Refractory metal alloys, Rolling (Metallurgy)), (*Rolling (Metallurgy), Refractory metal alloys), (*Vacuum apparatus, Rolling (Metallurgy)), Molybdenum alloys, Titanium alloys, Zirconium alloys, Niobium alloys, Tantalum alloys, Tungsten alloys, Casting alloys, Powder alloys, Sheets, Rolling mills, Controlled atmospheres, Mechanical properties, Surface properties, Microstructure, Hardness, Tensile properties, Ductility, Impurities, Temperature, Pressure, Deformation, Vacuum, Impurties.

Ten representative refractory metal alloys were chosen for vacuum rolling studies. The degree and/or the effect of contamination incurred on 90Ta-10W, F-48, D-31, TZM, and Mo+0.5%Ti sheet hot rolled at 0.5 microns and at 100 microns pressure was evaluated over a range of rolling parameters. Data is presented showing qualitative differences in fabricability with pressure of each of these alloys. Mechanical property and metallographic data provide a quantitative indication of vacuum purity levels required to prevent surface contamination or minimize its effect in various alloys. Two alloys - D-41 and W+.6CB - could not be successfully processed to starting size sheet for vacuum rolling studies due to the lack of sufficiently developed sheet processing procedures. In addition, technical difficulties prevented the vacuum rolling and evaluation of three tungsten base materials chosen for evaluation. (Author)

AD-417 316 Div. 26, 17
OTS Prices: HC $1.00/MF $0.50

McDonnell Aircraft Corp., St. Louis, Mo.
REAGING OF INCONEL X SHEET MATERIAL AFTER SEAM WELDING.
Final rept.,
by John Huebner. 10 Sep 63, 22p MAC-A065
Contract AF33 657 11215

Unclassified report

Legibility of this document is in part unsatisfactory. Reproduction will be made from best available copy.

Descriptors: (*Nickel alloys, Aging (Materials), (*Welding, Nickel alloys), (*Heat treatment, Nickel alloys), Chromium alloys, Iron alloys, Aluminum alloys, Titanium alloys, Niobium alloys, Heat-resistant metals and alloys, Sheets, Welds, Mechanical properties, Distortion, Ducts, Tensile properties, Microstructure.

Solar Aircraft has reported excessive distortion in the fabrication of BLC ducts when Inconel X sheet is seawelded in the annealed condition and then heat treated. To eliminate this, Solar proposes to weld the Inconel X after heat treatment followed by reaging. To examine the effect of this procedure on the mechanical properties of Inconel X, three test panels were fabricated. Panel 1 was welded in the annealed condition and then heat treated (MAC procedure), Panel 2 was heat treated followed by welding and Panel 3 was heat treated, then welded followed by reaging per Solar procedure. Tensile tests on specimens from

Descriptors: (*Potassium, Toxic tolerances), (*Toxic tolerances, Potassium), Amphibians, Reptiles, Birds, Mammals, Potassium compounds, Chlorides, Lethal dosage, Temperature, Muscles, Nervous system, Blood circulation, Tissues (Biology), Electolytes (Physiology), Cells (Biology), Injection (Medicine).

In certain amphibia, reptiles, birds, and mammals it was found that 0.9 to 1.5 mg/gram body weight KC1 was the minimal lethal dose for normal adult specimens. One hundred and ten toads and 814 mice were used to establish the dose lethal to 50% of the animals. In mice this was found to approximate 0.01 ml/g of 6.35 KCl i.p. Death usually occurred in 5 to 16 minutes. For toads kept at an environmental temperature of 20 - 22C the LD50 was calculated to be 0.01 ml/g of 8% KCl. Symptoms of potassium poisoning are described for the various species with reference to muscular, vascular and nervous systems. It was found that some of the changes were reversible, if smaller amounts were used, but that the time relation of the return to normal conditions was not the same for all tissues. (Author)

PB-160 100 Div. 16
OTS Prices: HC $1.00/MF $0.50

Naval Medical Research Inst., Bethesda, Md.
THE PRESENT STATUS OF OUR EXPERIMENTS WITH FREEZE-DRIED GRAFTS.
Research rept., vol. 13, p. 291-304,
by William H. Sewell, Douglas R. Koth, James W. Pate, and Wallace C. Bedell. 27 Jun 55, 14p
Proj. NM007 081 10 14

Unclassified report

Descriptors: (*Freeze drying, Tissues (Biology)), (*Transplantation, Freeze drying), (*Surgical techniques, Transplantation), Storage, Cells (Biology), Adaptation (Physiology), Arteries, Bone, Skin, Esophagus, Biliary system, Urinary system, Biological contamination.

Freeze-dried tissue used for grafting has been successful after storage at room temperature for periods of more than two years. The cells of the grafts are dead, but the parts of the tissues which perform only mechanical functions continue to carry out their role while the host replaces them with its own tissue. Host tissue reaction to the freeze-dried grafts has been demonstrated to be less than that of comparable fresh homologous tissue. In dogs freeze-dried arterial homografts have given better results than fresh homografts, and freeze-dried arterial heterografts were superior to fresh heterografts, though inferior to the homografts. Freeze-dried homologous bone appeared as satisfactory as homologous bone preserved by other methods. Other tissues, when freeze-dried and used as homografts, gave good results where sterility could be maintained. Dura and fascia used to replace the respective host tissues were satisfactory. Arteries were used successully as tendon sheaths. However, experiments failed in which the surface of the freeze-dried tissue was exposed to contamination or strong chemical irritation. Projects in which freeze-dried artery was used for esophagus, common bile duct, and ureter are examples of this latter type. Freeze-dried skin used experimentally as homografts sloughed at about the same time as fresh homografts of skin used as controls. (Author)

PB-160 101 Div. 16
OTS Prices: HC $1.00/MF $0.50

Naval Medical Research Inst., Bethesda, Md.
THE PRESERVATION OF ARTERIAL SEGMENTS BY THE FREEZE-DRYING METHOD,
by Albert G. Marrangoni and L. P. Cecchini.
19 Jun 50, 16p
Proj. NM007 081 10 02

Unclassified report

Descriptors: (*Arteries, Freeze drying), (*Freeze drying, Arteries), (*Transplantation, Arteries), Aorta, Storage, Tissues (Biology), Adaptation (Physiology), Thrombosis, Surgical techniques, Elasticity, Pathology, Infections, Histological techniques.

Segments of femoral arteries and aortas 2 to 10 cm. long were removed from donor dogs, frozen, and lyophilized. Lyophilized vessels were implanted in two groups of dogs; in one group, grafts were implanted into femoral arteries; and the other into abdominal aortas between the renal and inferior mesenteric arteries. The vessels were hydrated with physiological saline before implantation. Vascular channels of satisfactory size resulted in all experiments. Grafts were studied from seven days to three months after implantation. These vessels seem capable of withstanding arterial pressure and resemble homografts in all respects. There is little thrombus formation. In animals observed, firm union could always be demonstrated between the graft and the host. From these preliminary experiments it is believed that lyophilized vessels may be used in human subjects if circumstances demand the immediate bridging of arterial defects. (Author)

PB-160 109 Div. 16
OTS Prices: HC $1.00/MF $0.50

Naval Medical Research Inst., Bethesda, Md.
THE MEASUREMENT OF HIGH FREQUENCY SOUND VELOCITY IN MAMMALIAN SOFT TISSUES.
Research rept., vol. 12, p. 293-298,
by D. E. Goldman and J. R. Richards. 30 Jun 54, 8p
Proj. NM004 005 03 07

Unclassified report

Descriptors: (*Sound transmission, Tissues (Biology)), (*Tissues (Biology), Sound transmission), (*Acoustic properties, Tissues (Biology)), Interferometers, Measurement, Sound, Velocity, Liquids, Mammals, High frequency, Temperature, Audiofrequency, Diagnosis, Therapy, Pathology.

A two crystal interferometer for rapid measurement of sound velocity in liquids and soft animal tissues is described. Velocities can be determined to within three parts per thousand with a path length of a few millimeters. The frequencies used are 1,2,4,12, and 36 mc. Temperature is controlled to 0.1C. A phase comparison method is used for wave length incorporating a dual heterodyne reduction to audio-frequency with presentation as a Lissajous figure on an oscilloscope. Results are given for a few mammalian tissues showing the precision and reproducibility of measurements. (Author)

PB-160 111 Div. 16
OTS Prices: HC $2.00/MF $0.50

Naval Medical Research Inst., Bethesda, Md.
THE MECHANISM OF LOCAL COLD INJURY.
Research rept., vol. 11, p. 741-766,
by H. T. Meryman. 2 Jun 53, 34p
Proj. NM000 018 01 07

Unclassified report

Descriptors: (*Freezing, Tissues (Biology), (*Frostbite, Pathology), (*Military medicine, Frostbite), Cold weather tests, Injuries, Cells (Biology), Damage, Anoxia, Exposure, Body temperature, Cardiovascular system, Metabolism, Nerve impulses, Diseases, Visual inspection.

An investigation into the mechanism of cold injury was made both experimentally and theoretically. Freezing of tissue was shown to produce massive cellular dislocation which undoubtedly causes a nonspecific, irreversible cell damage. Cold injury without freezing introduced selective, cummulative damage, primarily through anoxia, into otherwise viable tissue. The outlook for early therapy in either injury is discussed but not considered hopeful. However,

32. Miscellaneous Arts and Sciences

PB-166 174 Div. 32, 30
OTS Prices: HC $5.00/MF $1.00

Princeton Univ., N. J.
THE DECISION OF ARNOLD SCHOENBERG'S TWELVE-NOTE-CLASS SYSTEM AND RELATED SYSTEMS,
by Michael Kassler. 1961, 170p

Unclassified report

Descriptors: (*Music, Mathematics), (*Decision theory, Music), Language, Programming (Computers), Digital computers, Communication theory.

The paper represents the first known attempt to explicate structural characteristics common to the elements of a large set of written musical compositions (twelve-tone) by 'rationally reconstructing' a logical system, of which the compositions are instances under interpretation, with rigor sufficient to permit the presentation of what is essentially a general-purpose-digital-computer program for the decision procedure of the system.

PB-166 199 Div. 32, 30
OTS Prices: HC $1.00/MF $0.50

Computation Lab., Harvard Univ., Cambridge, Mass.
SOME FLEXIBLE INFORMATION RETRIEVAL SYSTEMS USING STRUCTURE MATCHING PROCEDURES,
by Gerald Salton and Edward H. Sussenguth, Jr.
1964, 12p
Grant NSF GN82

Unclassified report

Proceedings - Spring Joint Computer Conference 1964, p. 587-597.

Descriptors: (*Information retrieval, Data processing systems), Identification, Language, Word association, Subject indexing, Documentation, Programming(Computers), Dictionaries, Graphics, Topology, Set theory.

A topological structure-matching procedure was programmed for the 7090 computer which does not depend on a specific ordering of the nodes, nor on the presence or absence of certain specified substructures. Little or no backtracking is required, and the method can be used to detect complete as well as partial matches. The basic idea is to determine certain simple properties of the nodes of the two structures to be matched, and to equate those subsets of the nodes in the two structures which exhibit equivalent properties. A standard procedure is then used to form new matching subsets, and to break down already existing subsets into sets with fewer members. The procedure is completely determinate except in cases where it is necessary to resolve certain symmetries in the connection pattern of the nodes.

PB-181 566 Div. 32
OTS Prices: HC $1.25/MF $0.50

Naval Research Lab., Washington, D. C.
REPORT OF NRL PROGRESS,
Sep 64

Unclassified report

Descriptors: (*Scientific research, Reviews), (*Naval research, Reviews), Nuclear physics laboratories, Algae, Chemistry, Esters, Electrochemistry, Mechanics, Fracture (Mechanics), Plastics, Metallurgy, Niobium, Titanium alloys, Refractory metals, Metal films, Ceramics, Crystal growth, Steel, Optics, Nitrogen, Radio, Luneberg lens antennas, Radar, Solid state physics, Crystals, Phase studies, Patents.

Contents:
The NRL High Level Radiation Laboratory, by H. E. Watson and L. E. Steele
Pressure as a Factor in Algal Growth, by P. J. Hannan
Chemistry: Synthesis, characterization, and ester-ester interchange study of 2-ethylhexyl benzyl azelate. Investigations of the kinetics of hydrogen and oxygen reactions on a platinum electrode.
Mechanics: A comparison of cyclic fatigue crack propagation with single cycle crack toughness and plastic flow. Compression failure mechanisms in glass reinforced plastics.
Metallurgy and Ceramics: Fracture toughness tests for titanium alloy plate and forgings. Influence of test conditions on the behavior of refractory metals. Niobium bicrystals. Metallographic study of fatigue damage. Ferromagnetic resonance of irradiated iron-nickel films. Growth of prismatic Al2O3 crystals on Sn-Al alloys. Electrical properties of FeO. Development of high strength structural steels.
Optics: Molecular Spectra of Nitrogen.
Radio: Characteristics of the Luneberg lens antenna at Molokai. A fixed-array, high-data-rate, search and height-finding radar.
Solid State Physics: Indirect Optical transitions in KBr. Colloids in alkalai halide crystals. Anodization as a technique for distinguishing phases in Zr-Ni alloys.

these panels (welded and unwelded) showed equivalent mechanical properties for MAC and Solar procedure. The hardness through the weld is slightly lower for the Solar procedure, but the hardness through the fusion zone and unaffected zone follows the same pattern as for MAC procedure. Welds in all panels showed some intrusion and Panel 1 also showed excessive expulsion. (Author)

AD-417 321 Div. 26, 17
OTS Prices: HC $1.00/MF $0.50

McDonnell Aircraft Corp., St. Louis, Mo.
INCONEL X WELDMENTS--SPECIAL HEAT TREATING. Final rept.,
by John Huebner. 10 Sep 63, 22p MAC A066
Contract AF33 657 11215
N63 21665

Unclassified report

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Descriptors: (*Nickel alloys, Welds), (*Welds, Heat treatment), (*Heat treatment, Nickel alloys), Chromium alloys, Iron alloys, Aluminum alloys, Titanium alloys, Niobium alloys, Fracture (Mechanics), Stresses, Tests, Heat-resistant metals and alloys, Microstructure.

Heat treatment of light gage Inconel X weldments often results in the formation of cracks in fusion weld zones. To evaluate this behavior, weld restraint specimens were fabricated, which approximate the stress conditions in .025 to .025 butt-welded Inconel X weldments, and heat treating schedules were varied in an attempt to produce cracking. The basic heat treating schedule followed was an 1100F thermal stress relief, a 1700F stress relief, and a two-hour, 1300F age. Eighteen different heat treating cycles were evaluated, based on combinations of three variables: (1) hold-time at 1100F, (2) heating rate from 1100F to 1700F, and (3) hold-time at 1700F. After heat treatment, the welds were examined by means of visual inspection, zyglo penetrant inspection, X-ray radiography, and metallography and found to be free of cracks. (Author)

AD-442 482 Div. 26, 17
OTS Prices: HC $1.00/MF $0.50

Foreign Tech. Div., Air Force Systems Command, Wright-Patterson AFB, Ohio.
METHOD OF PRODUCING FINE WIRE,
by L. A. Lysenko and N. S. Agushevich. 11 Jun 64, 6p
FTD TT64 99; TT 64 71193

Unclassified report

Unedited rough draft trans. of Russian patent 156,146, appl. no. 777,527/22-2, 27 Apr 62.

Descriptors: (*Wire, Drawing (Machine processing)), (*Drawing (Machine processing), Wire), Manufacturing methods, Gold, Platinum, Copper, Gold alloys, Platinum alloys, Pipes, Thickness, Composite materials, Cladding, Material removal, USSR.

Invention consists of a method of obtaining thin wire, for Ex., of the diameter of 0.001 mm, by drawing a bimetallic billet with subsequent scouring of the outer surface which is distinguished by the fact that for the purpose of getting a constant section of a finished wire one gets a bimetallic billet by introducing a core of one metal into a tube of another metal prepared with high polish of the inner surface. (Author)

30. Research and Research Equipment

AD-442 481 Div. 30, 9
OTS Prices: HC $1.00/MF $0.50

Foreign Tech. Div., Air Force Systems Command, Wright-Patterson AFB, Ohio.
SIX-COMPONENT WIND-TUNNEL BALANCE,
by N. P. Levitskii. 12 Jun 64, 8p
FTD TT64 46; TT 64 71192

Unclassified report

Unedited rough draft trans. of Russian patent 152 117 (appl. no. 755147/26-10, 12 Dec 61).

Descriptors: (*Wind tunnels, Balances), (*Balances, Wind tunnels), Design, Model tests, Weight, Aerodynamic configurations, Electrical equipment, Membranes, Sensitivity, Instrumentation, USSR.

Invention consists of a six-component wind-tunnel balance in which a model is provided with fairing, the model being connected with a holder with the sensitive elements of the balance for which there are used inductive converters of displacements, the converters being connected up to a bridge circuit into the arms of which there are introduced supplementary converters for compensating the moments not subject to measurement, the balance being distinguished by the fact that, for the purpose of measuring small aerodynamic forces, for determining horizontal forces and moment there is used a frame on elastic supports bearing the core of the converters, and for the determination of the vertical force and moments a membrane is used the axis of which coincides with the direction of the force to be measured. (Author)

31. Ships and Marine Equipment

PB-166 092 Div. 31, 25
OTS Prices: HC $2.00/MF $0.50

Institute of Engineering Research, Univ. of California, Berkeley.
POST-BUCKLING BEHAVIOR OF WIDE SHIP PLATING - - NUMERICAL RESULTS,
by H. G. Schultz, Feb 64, 50p NA-64-3
Contract MA2620, T. O. 4

Unclassified report

Descriptors: (*Ship plates, Deflection), Buckling (Mechanics), Stresses, Compressive properties, Loading (Mechanics).

Using Levy's general solution for the differential equations of plates with large deflections, the post-buckling behavior of wide plates is investigated numerically. The results obtained show that the widespread use of the one-term solution, proposed by Bleich, can lead to an over-estimation of the load-carrying capacity of wide ship plating of more than 100%. The report contains two design charts with which the effective width and excess of buckling load accompanied by yield stresses in the plate can be obtained. The experimental investigation of the post-buckling behavior of a wide plate is discussed. (Author)

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